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UNITED STATES ARMY

AVIATION DIGEST

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HIND THE HIND

UNITED STATES ARMY AVIATION DIGEST

APRIL 1977 VOLUME 23 NUMBER 4

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ABOUT THE COVER

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The mission of the *U.S. ARMY AVIATION DIGEST* is to provide information of an operational or functional nature concerning safety and aircraft accident prevention, training, maintenance, operations, research and development, aviation medicine and other related data.

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The YAK-24 "Horse" of more than 20 years ago established load and altitude records. Succeeding pages show a few of the helicopters in the Soviet inventory

Soviet Airmobile Tactics

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This article represents the opinions of the author which are derived from his studies in open literature. They in no way represent or imply indorsement by the U. S. Army Aviation Center, the Department of the Army or the Department of Defense

SOVIET AIRMOBILITY has come of age as a potent part of the Soviet forces combined arms team. The evolution of a large, modern helicopter fleet within the Soviet Union bears witness to the fact that Soviet military planners have not ignored this critical aspect of modern combat. This article examines the intensified interest that the Soviets have been showing in airmobile operations; the helicopters that currently are in their inventory; and the methods and tactics of their employment in combat.

The combat effectiveness of the U.S. Army is dependent on the helicopter. The helicopter has revised the concept of the modern battlefield, reducing troop exposure and enhancing economy of force.[1]

The truth of this statement by former Under Secretary of the Army Norman R. Augustine certainly has not been lost on the other armies of the world. A quick look at the foreign military sales being generated by the United States alone will show that countries throughout the world consider the helicopter to be a very desirable piece of military equipment. Interest has heightened with the realization of the potential of the helicopter as a first-rate antitank system.

The Mi-24 "Hind" could carry eight combat equipped soldiers but its punch comes in armament — a nose machinegun, four antitank missiles and four pods each with 32 57 mm rockets

Recognition of this potential by European military powers is evident:

In virtue of their maneuverability, their great firepower, and the possibility of employing them rapidly and against a target, combat helicopters ought to play a major role as powerful antitank weaponry in conducting defensive battles.[2]

The new concept of the tank destroyer gunship (TDG) emerges; an ideal step towards a ground combat weapon, capable of flying, has been taken.... The main task of the TDG is combat against tanks; beyond this it should be capable of carrying out additional missions through its movement and armament:

- *escort for transport helicopter units.*
- *fire support from the air against enemy airborne operations.*[3]

...the tank destroyer gunship, as an operative strong point weapon of the future, has a far greater effectiveness than every presently known and conceivable weapon system which is being developed.[4]

The Soviets have taken note of the U. S. Army's development of airmobile operations and have seriously studied our tactics and technology. Their writings show an awareness of our tactics, not only as an essential aspect of a modern, highly mobile army,[5] but also with respect to specialized training in combating a helicopter threat.[6]

In addition, for many years Soviet writers have been advocating the employment of helicopters as an integral part of the combined arms

team irrespective of Western actions. The numerous missions which the Soviets have traditionally considered for airborne forces are now being proposed as excellent for helicopter-landed forces because of the helicopter's high maneuverability; fewer constraints from adverse weather; faster employment; and very small requirement for specialized training.[7] In an article entitled, "Maneuver In Battle," Colonel V. Sankin, a prominent Russian military theoretician states:

> *Maneuver by air can be considered a fourth form of maneuver in modern combat. The great spatial sweep of combat action and the trend toward executing missions in compressed periods of time and, hence, the much greater importance of the factor of time — all this increases the role played by maneuver by air and it in turn contributes to continuity of attack and attaining a high tempo.*[8]

A number of additional examples of the Soviet awareness of helicopter potential on the modern battlefield could be cited but this should suffice when it is realized that they have backed up this awareness with a modern helicopter fleet and complete tactics of employment.

The Soviet Union's armed forces have a large (2,500)[9] helicopter fleet which is being rapidly modernized. The majority of these helicopters are assigned to multipurpose helicopter units which are organized as part of the Frontal Aviation Army. These units are regimental size and include the assets necessary to conduct a tactical lift of a complete motorized rifle battalion.[10] The Frontal Aviation Army stationed with the Group of Soviet Troops in Germany (GSTG) has two or three helicopter regiments assigned.[11] It is important to remember that the Frontal Aviation Army, which is assigned to the military district even in peacetime, enables that commander to have immediate control of the ground forces *plus* the aviation support should war break out.[12]

The Mi-8 "Hip" can accommodate up to 32 equipped soldiers. Four 16 pod 57 mm rockets can be mounted suiting this helicopter to either transport, airmobile or ground attack roles

Although the Soviet Union is the world's leader in heavy lift helicopters, these huge transports probably will not be found as an organic part of the regiment. The primary vehicles of the modern Soviet force are the Mi-8 Hip and the Mi-24 Hind. The Mi-8 first was introduced in its military version in 1967. It has twin 1,500 horsepower turbine engines and is capable of carrying 24 passengers or 8,800 pounds internally or 6,600 pounds externally. The Hip has a cruising range of 264 miles with a maximum cruising speed of 140 mph.[13] Military versions can be equipped with external stores which can be rockets, machineguns, or antitank guided missiles (ATGM).

The Mi-24 gunship which has been in service since early 1974 has been produced in two versions, the Hind B (which preceded the Hind A) which is armed with a 12.7 mm machinegun and four 57 mm rocket pods. In addition to this armament, the Hind A has an outboard weapons station on each auxiliary wing which mounts launch rails for two "Swatter" or "Sagger" antitank missiles. The Mi-24 is powered by two turbine engines that are thought to be smaller than the system in the Mi-8.[14]

The new FM 90-1, "Employment of Army Aviation Units In A High Threat Environment," asserts that the Hind A also is armed with a 23 mm cannon mounted in a chin turret.[15] This possibility was substantiated by *AVIATION WEEK AND SPACE TECHNOLOGY* in a news report stating:

> *Soviet Union has a major program underway to develop an advanced attack helicopter, a long-range, self-guiding missile to arm it and the tactics necessary to employ it in conjunction with a mobile armored strike force....Soviets have flown a new attack helicopter, with a different rotor system, tandem gunner-pilot seating and a radar-directed 23 mm gun*

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Behind The Hind

This article has been prepared exclusively from unclassified sources, primarily Soviet. Technical data on the Hind was extracted from the January 1976 issue of *Interavia*. It in no way represents or implies the views of the U.S. Army Aviation Center, the Department of the Army or the Department of the Defense.

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SOVIET GROUND force doctrine and training for both conventional and nuclear warfare place primary emphasis on offensive operations. Their major efforts are directed toward maximizing the use of surprise, firepower, maneuver and speed. In order to enhance attainment of their goals, the Soviets have devoted great effort to studying the tactical successes of Western armies and applying those lessons to their own technological efforts.

Former Secretary of Defense Donald Rumsfeld's Posture Statement for FY 1977 revealed that helicopter production is the only major weapons system area in which the United States still leads the USSR – a lead which may be slowly dissipating.

The Soviet component comparable to U. S. Army aviation has been receiving steadily increasing attention as evidenced by force structure changes and equipment modernization efforts. The heavy emphasis placed upon airmobility by the U. S. Army and the demonstrated combat utility of the helicopter in Korea and South Vietnam have undoubtedly influenced Soviet efforts.

Soviet journals pay a great deal of attention to U. S. airmobility doctrine but, typically, Soviet efforts are inadequately publicized in our own professional journals. Therefore, a look at their most recently fielded tactical helicopter should prove instructive.

First let us recognize that, because of the Soviet Union's centrally controlled economic system, it is better able than the West to focus development and production efforts during peacetime. This in turn results in accelerated development cycles for weapons systems. Thus, they have been able to progress within 6 years from an initial policy of modifying existing helicopters to carry armaments, to fielding, in 1973, a fully developed troop carrying gunship designed specifically for the combat role. This new type helicopter, the Mil Mi-24, is code named Hind and its description, capabilities and probable employment are the subjects of this article.

The Hind appears to combine the squad carrying capability of the U. S. Army's UH-60A UTTAS with the firepower of the AH-64A AAH (excluding HELLFIRE), neither of which have yet gone into production. Although the Hind probably does not match the technological sophistication found in either the UTTAS or the AAH, it is an impressive piece of equipment whose dynamic systems (engines, rotors and transmission) are all of new or improved design.

With an estimated maximum gross weight of 18,500 pounds, the Hind has twin gas turbine engines with projected power in the vicinity of 1,500 shp (shaft horsepower) each. Retractable landing gear and stub wings combine to assist in attaining speeds in excess of 160 knots.

The five bladed main rotor and three bladed tail rotor are hydromechanically controlled

and designed to reduce the helicopter noise signature. Both rotor systems have electric trim and deicing. Although we do not yet know how effective this rotor deicing capability is, the fact that it exists on equipment in the field represents a significant advantage over comparable U. S. helicopters. Deicing for the engine air intakes and the windshield is accomplished by diverting warm air from the cockpit/cabin heater.

The three man crew consists of a pilot, copilot and gunner. The pilot and copilot sit side-by-side (with the pilot on the left) immediately behind the gunner who controls his panoply of weapons from the nose of the ship. Behind the crew compartment is a large cabin capable of carrying 16 lightly armed troops or a fully equipped eight man antitank squad.

The armament system is equally impressive and consists of a nose mounted 12.7 mm machinegun and wing stations which can accommodate four antitank guided missiles and 128 free flight armor piercing rockets (in four pods). The normal missile/rocket configuration may be tailored to carry larger caliber air-to-surface rockets, gun pods or bombs in any combination. Recent Soviet writings have led to speculation that they may be also experimenting with air-to-air missiles and developing tactics for an antiair (helicopter and fixed wing) role.

No information is available on the Hind's maintenance requirements. If, however, they continue to follow the pattern of earlier helicopters, we can expect 1,000 hours before the first scheduled major maintenance inspection and 500 hours between subsequent inspections. One Western helicopter expert observed, "It's undoubtedly true that all you have to do to keep their helicopters operating between overhauls is to pour oil into the transmission and fuel into the tank."

Performance parameters of the Hind appear to be quite adequate for its dual mission capability. The Hind has a maximum sea level speed of 168 knots and an endurance of 2 hours and 25 minutes at a sea level cruising speed of 159 knots. It can climb at the rate of 2,460 fpm (feet per minute) at sea level; has a 14,700 foot service ceiling; and can hover out of ground

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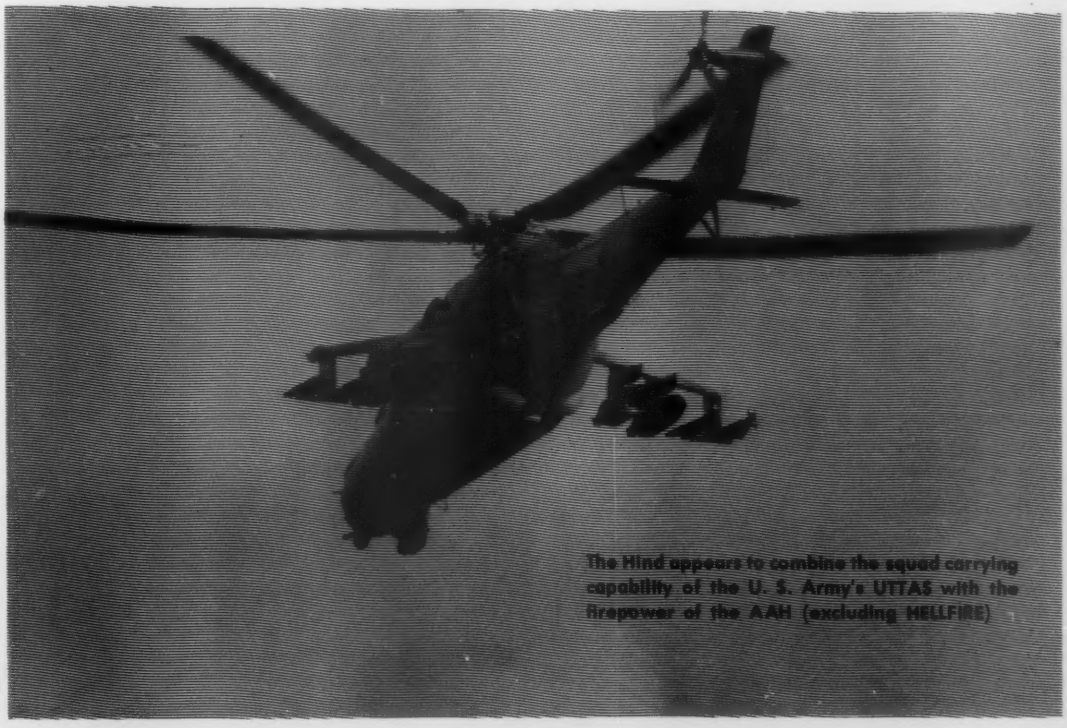

The Hind appears to combine the squad carrying capability of the U. S. Army's UTTAS with the firepower of the AAH (excluding HELLFIRE)

NEW GUY GOES

IMC

WO1 Lon C. Cooper
38th Aviation Battalion
Michigan National Guard

Never travel on training flight without complete, current flight information publications (FLIPs), and practice instrument approaches despite it being VFR

AH, THE LAST night of Annual Training. "Can't hardly wait to get home to see the wife and kids," I was thinking as I walked the 200 yards or so from the company area to the Grayling Army Airfield operations building.

I was on my way to visit "Doc," my "stick buddy," who was on his turn as medevac pilot. Most of the company was out on the town as today was payday. It was 2000 hours, and after a good dinner and a little nap, I looked forward to a little conversation before I turned in for the night.

Doc was there, as were several other pilots prior to going into town. Flight operations (OPS) was a good starting point for most anything and a good place to leave a message about where one could be reached. As usual, a conversation was in progress about the "war of AT-75," and how "they" did things in the "big one" several years ago. After hearing each story two or three times, one by one they left in search of someone who had heard the story only once, or not at all. Someone produced a deck of cards, and with a makeshift table and chairs, the "nightlong" game began.

About 2200 hours the game slowed and finally stopped. I agreed to fill in for the alternate medevac pilot who wanted to go out for a bite to eat and call home. Besides, the likelihood of a mission was slim.

About 15 minutes later the telephone rang. Doc answered, and it was the Company A executive officer calling from the officers' club to put the medevac team on notice of a possible mission. I was, in turn, notified along with our crewchief (CE). The UH-1H Huey had been preflighted during daylight, and while Doc helped the CE untie the ship, I ran down to my tent to get my flight equipment. A short time later the mission order came down. The flight would be made to Saginaw, MI. Doc and chief went out to the aircraft, and I filed a civilian flight plan (counterpart to the DD 175-1). Weather would not be a factor as it was forecast visual flight rules (VFR) roundtrip. By the time I completed the flight planning and filing Doc was ready to crank. OPS came over the tactical radio (FM) and gave us the pickup zone (PZ).

During the short hop to the PZ, I briefed the crew on the route, and called OPS again to open our flight plan with Traverse City flight service station (FSS). Doc had us on an approach to the lighted pad and I could see the ambulance waiting for us.

As soon as we landed and opened the cargo doors the medics began placing the patient aboard. The executive officer was there and briefed us on the patient's condition and what was to be waiting for us in Saginaw, some 90 miles away. There was no mistake about the condition of the injured sergeant. He had been cleaning an armed personnel carrier (APC) when a crew hatch fell on his head.

We experienced no intlight problems enroute to Midland, MI. A little farther toward Tri-City Airport near Saginaw, I called Saginaw approach control and gave them my position and was put on radar. The controllers knew of our mission, and the ambulance was on the field ready to pick up the injured sergeant and transport him to the hospital. I asked for clearance straight-in to the ramp near the ambulance and traffic was opened for us. I landed on the ramp, the medics and the ambulance crew transferred the sergeant in a highly professional

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Airmobile Operations Under Radio Silence Conditions

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MODERN ARMIES have capitalized heavily on technical advances in the area of electronic communications to keep all levels of the chain of command informed of the latest developments in a constantly changing field situation. Aviation units have come to rely almost exclusively on the radio during aerial operations. This is partially because of a lack of development of any realistic alternate method – and partially because our most recent battlefield opponent displayed no real capacity of radically affecting our mission through electronic countermeasures.

Our potential enemies place great stock in the effects of electronic warfare and accordingly equip even their smallest units with jamming devices capable of disrupting radio communications. It is not unreasonable to expect that our next adversary will possess the means necessary to at times make control through radio communications difficult, if not impossible.

Unfortunately, radio beams do not distinguish friend from foe and anyone on the same frequency within range can monitor. The availability of direction-finding equipment makes every radio transmission a possible source of locating friendly positions. By plotting a series of aircraft transmissions, the enemy could easily determine direction and rate of travel, and alert antiaircraft emplacements along the expected route.

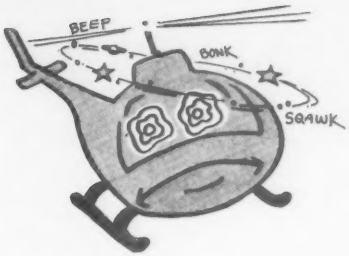
Radar used on the ZSU-23-4 is much more effective scanning a 60-degree arc than a full circle. The probability of receiving enemy fire is increased every time the trigger is pulled to transmit over tactical radios. Terrain flight altitudes are a definite plus for airmobile operations in future battlefield environments, but the effectiveness of operating at these altitudes will be partially negated if radio transmissions are allowed to give away aircraft locations. Therein lies the problem.

Aircrews operating in low intensity and training environments tend to coordinate last-minute details over the radio while enroute to accomplish the mission. This type of coordination has definite positive implications. Airmobility has enjoyed success because of timely reaction and instant flexibility caused by rapid communication. On the negative side, many unnecessary transmissions are made. If radio traffic is to be reduced or eliminated with the ensuing loss of enroute coordination over tactical radios, premission planning becomes a major area of interest. Additionally, visual signals must be developed which compensate for the loss of radios in certain environments and help to retain flexibility and timely reaction.

The following information is offered as a guide to the premission planning phase of radio silence airmobile operations and preplanned signals which encompass the more common events and maneuvers associated with airmobile operations. Unit SOPs (standing operating procedures) should be developed to encompass specific unit needs, and each crewmember should be made thoroughly aware of the contents.

Preplanning Phase. Upon receipt of the operations order, the air mission commander should:

- Plan a route of flight and perform a map study to determine the best route of flight using



METEOROLOGICAL

...encountering unexpected IMC enroute would require radio silence be broken so that positive control of the formation could be maintained and breakup procedures implemented...

terrain features which will conceal the formation from known or suspected enemy locations.

- Designate aerial checkpoints which are recognized easily and can be used to check enroute times; change route directions; signal impending change of formation; and align the formation for final approach.
- Perform an aerial photo or map study of available landing zones (LZs) to determine approach and departure paths and landing direction; use the most current weather forecast to choose the landing direction with favorable winds; study the intelligence summary to pinpoint and avoid enemy locations; and, using the above information, determine the best formation for landing.
- Select alternate LZs which can be used if enemy presence will render the primary LZ unusable; ensure alternate LZs are located at sites which facilitate mission accomplishment.
- Measure the route to see if refueling is necessary during the mission; plan the route to include stops at existing FARRPs (forward area refueling and rearming points) or arrange for prepositioned fuel as required.
- Designate coordination points throughout the mission where key personnel can gather to coordinate any last-minute changes to the mission; prior to start, assembly area, pickup zone (PZ) and refuel points are considerations.
- Use reverse planning sequence to determine start time; formup time; assembly area time; PZ arrival and departure time (if different from assembly area); checkpoint time; refueling times, as necessary; supporting fires start and stop times, if used; and use 10 knots less than cruise for planning purposes. Areas close to or beyond the forward edge of the battle area (FEBA) which will require nap-of-the-earth (NOE) flight should be timed accordingly.
- Coordinate supporting fires and helicopter gunship cover.
- Designate signals to be used for any mission peculiar functions not covered in the unit SOP.
- Brief all aviation and support personnel simultaneously, if possible.

Now that the basic plan has been discussed, the next step is to determine appropriate formation signals. Maneuvers common to all airmobile operations and signals that can be used are covered in the following paragraphs.

Start. All aircraft will start engines 10 minutes prior to formup time when flight lead's blades begin to turn. If this occurs at the basefield or other secure area, a communications check will be made on all mission frequencies to ensure radio communication with all elements. Each navigator/crewchief can exit the aircraft at this time to act as fire guard and to signal the condition of the aircraft by thumbs up or down to the lead ship navigator/crewchief. At night the fire guard may signal the aircraft up by waving one flashlight vertically or signal it down by waving one flashlight horizontally.

Formup. All aircraft will move into the predesignated formation when lead begins to move. If it is to be a large formation, aircraft should move in order of chalk number to lessen the possibility of confusion.

Aircraft Loaded. Once the formation is in place, each navigator/crewchief will exit the aircraft and take a position in view of the flight lead navigator/crewchief. When the aircraft is loaded each navigator/crewchief will signal the lead aircraft with a thumbs-up signal during daylight operations and will wave one flashlight vertically during night operations. The navigator/crewchief will remain outside the aircraft until the signal for operating RPM

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$afety and the

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WHAT CAUSES accidents? How can accidents be prevented? Can a unit maintain a zero accident rate? What exactly is safety all about and why is it so important?

Safety – or the lack of safety – within a unit has been reflected in many commanders' efficiency reports. It also has caused commanders to be relieved of their commands. Safety is defined in the dictionary as freedom from danger, injury or damage. An accident is described as an unpleasant and unintended happening, sometimes resulting from negligence, that results in injury, loss or damage.

Few people realize the number of lives and dollars that are lost to just the military each year due to accidents. Therefore, we as members of the military must dedicate ourselves to supporting the safety policy of the Army, as defined in AR 385-10, which is to reduce and keep to a minimum accidental manpower and monetary losses, thus providing a more efficient utilization of resources and advancing the combat effectiveness of the Army.

Most accidents involve three basic elements: human, machine or equipment, and environmental. Records show that most of the accidents in the military are caused by human error rather than by machine error or environment. Therefore, the cause and effect of the human aspect will be developed in much greater detail than the machine or environmental aspects. In addition to safety and accidents in general, aviation safety will be the main topic discussed because Army aviation is such an expensive and highly technical program.

It is a costly process to train aviators to fly, and aircraft in this day and age are very complex, sophisticated and expensive. Everytime a CH-47 Chinook is lost due to an accident the Army loses about 2.1 million dollars. For that amount of money the Army can buy approximately 1,000 military sedans.

Why are most of the accidents caused by human failure? The lack of knowledge, skill, discipline or supervision of personnel operating and performing maintenance on ever increasing complex military equipment in varying environments leaves many areas where there is room for human error. These areas are also very closely interrelated. You cannot have one without the other.

To supervise one must have the knowledge and should have the skill. One might gain the knowledge of driving

Few people realize the number of lives and dollars that are lost each year to accidents. The key to safety is

supervision

$upervisor

or flying but will be dangerous until gaining the skill through training and experience. One might have the knowledge and skill but without exercising self-discipline will be subject to unnecessary risks and thereby increase the chances for an accident. In order to effectively reduce the human error margin, there must be an effective blend of knowledge, skill, discipline and supervision.

The crux of eliminating the human error has got to be at the operating level: company, platoon, section, etc. It is essential that operators know the equipment and its capabilities and limitations in varying environments. They must know their own capabilities and not go beyond them. They must exercise self-discipline through the use of common sense, good judgment and adhering to established standards, regulations and policies. When the operators possess the required knowledge and skill and exercise good discipline, they greatly reduce the chances of having an accident due to an error on their part.

The most important ingredients in reducing the human error aspect are the supervisors (company commander, platoon leader, section leader). The primary cause factor of accidents is the lack of supervision or the attitude of the supervisors. When the supervisors lack the knowledge of their people's capabilities and the equipment they operate, they cannot effectively exercise proper supervision. If they display a fatalistic or lax attitude toward safety by philosophizing that accidents are inevitable and cannot be prevented, this attitude will prevail throughout and accidents will occur.

Accidents just don't happen; they are caused. Supervisors must know what the cause factors of accidents are in order to prevent them. They must be able to identify potential hazards (personnel who are sick or who are not psychologically in the right frame of mind to safely perform their mission) and take positive, prompt steps to eliminate the potential accident. They must be on the alert and *always* looking for potential accident indicators.

If supervisors see a driver driving too fast, they should take action *then*, and not wait. If it happens again, they should relieve the driver. If aviation supervisors see aviators who have or are performing in an unsafe manner, they definitely have to take positive action. They might just counsel the

aviators. They might want instructor pilots to fly with the aviators and evaluate them from a safety standpoint. They might want to relieve them of aircraft commander responsibilities and make them copilots until the aviators have demonstrated that they are capable of reassuming the responsibilities of aircraft commander.

In any case, supervisors cannot just stand by idly and hope that the potential accident threat will disappear. They must take whatever action they deem necessary to reduce or eliminate the problem.

Lack of supervision also may stem from oversupervision in one area and completely overlooking another area. This sometimes happens in aviation units. Interest is directed solely to aircraft and flying and as a result there is a lack of supervision in operation and maintenance of wheel vehicles. Normally, however, when an aviation unit has a fine aviation safety record it will have good safety in all areas of operation within the company because the safe attitude developed toward flying will carry over into the other areas.

Supervisors are responsible for permeating a safe attitude to all of their subordinates. Enthusiasm is contagious. Supervisors must display an enthusiastic attitude toward safety and let their troops know they are dead serious about safety. They must let them know by their actions that they are concerned for their safety and also that they will not tolerate negligence that might cause a loss of lives and/or equipment. Supervisors cannot compromise. They must set the example and demonstrate good safe procedures.

The second element, the machine, is a primary participant in a vast majority of military accidents. Its damage or loss represents loss in dollars but it is not normally the primary cause factor of accidents. Materiel failure occurs much less frequently than human failure.

Many mechanical malfunctions are the result of an operator who exceeds the operating limits, or the mechanic who overtorques a nut, or has not assembled a system properly on the machine. Close supervision and technical inspections can greatly reduce these malfunctions attributed to human errors.

The final element, the environment, again is not a leading cause factor of military accidents. It is, in many cases, a contributing factor to the accident. Extreme temperature conditions may cause a driver to be less alert mentally.

People playfully wrestling in a work area could create a distraction for a person operating a piece of equipment and this could result in an accident. Rain and snow create unfamiliar and hazardous driving conditions for the driver of a military vehicle.

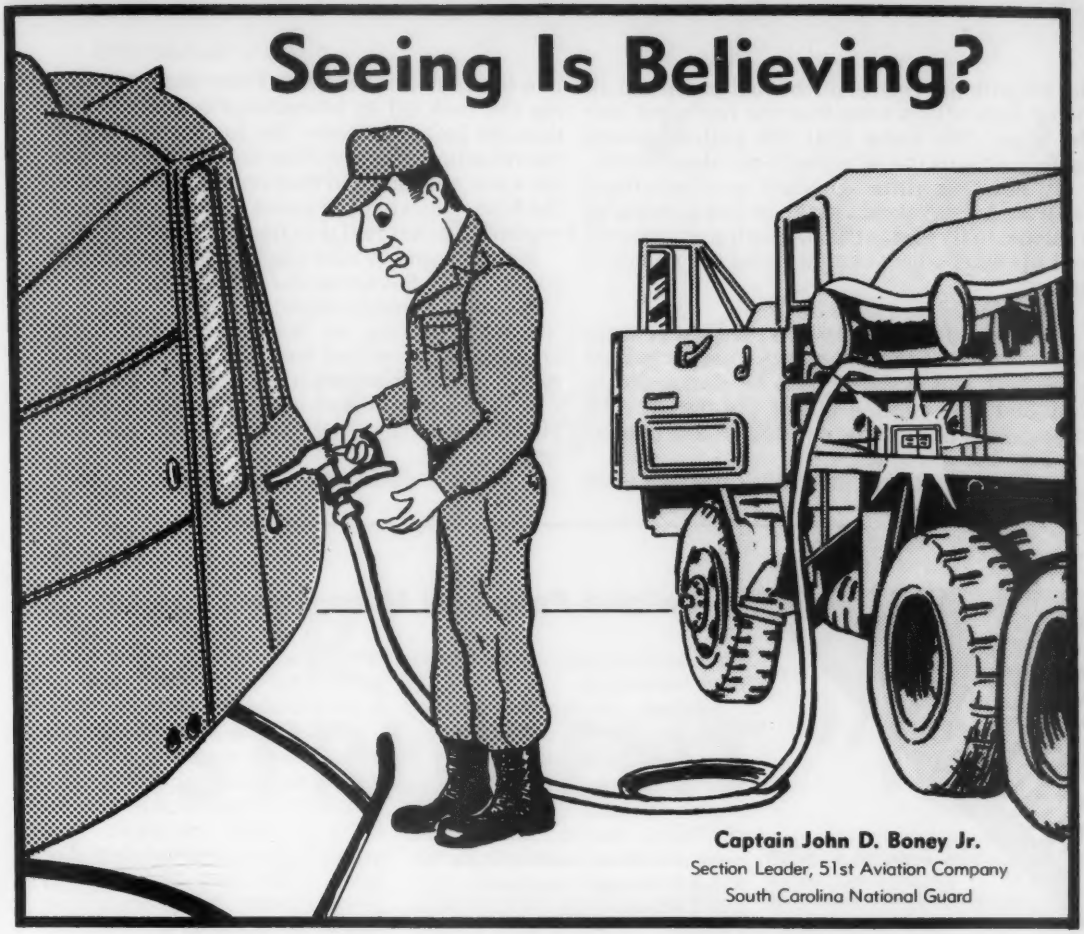
In aviation there are regulations governing our limits in adverse weather. This does not mean, however, that an aviator should fly just because the weather is within prescribed regulation limits. Good judgment and common sense has to be exercised by the driver or aviator in all cases when dealing with unfamiliar weather or environment. Supervisors must be aware of these environmental factors so they can sensibly educate their people on how to cope with these dangers and reduce the possibility of the environment luring them into an accident.

Units can and have maintained zero accident rates. An aviation company commander in U. S. Army Europe (USAREUR) recently maintained a zero accident rate with both wheel vehicles and aircraft, yet he never conducted a safety meeting once during his tenure as commander. Why was he so successful? He felt that safety meetings were not the answer because many people automatically form a mental block when they know they are required to attend a safety lecture. He solved the problem by living, preaching and breathing safety all the time. He encouraged everyone and anyone to discuss anything concerning safety during his weekly command meetings. He always conducted a debriefing after an airmobile operation.

Again, he encouraged his people to discuss anything they might have observed during the operation that they felt was an unsafe condition. He made his people feel that they were an important role in the safety program.

Safety councils and unit safety officers are very helpful but the key to safety is the supervisors. They instill the spirit and attitude of safety within their troops and once they have accomplished this they will greatly increase their chances of achieving a *zero accident rate*. As it has been so aptly stated many times in the Army, safety is a *Command Responsibility*.

Seeing Is Believing?



Captain John D. Boney Jr.
Section Leader, 51st Aviation Company
South Carolina National Guard

During review of this article the Director of Evaluation/Standardization, Ft. Rucker, stated that the author should be commended on his actions—pointing out this could very easily have been an accident report instead of a safety article. We agree

ON 7 NOVEMBER 1976 CW2 Paul T. Lyell and I departed McEntire Air Base enroute to Savannah, Georgia on a mission. This is normally a 1½-hour flight, and with a 2½-hour fuel capacity on the UH-1 Huey, Savannah is within the fuel range.

However, on this particular morning we encountered strong headwinds and the fuel consumption rate was above the average limits. About halfway into the flight a fuel consumption check determined that the fuel would be uncomfortably low upon arrival. We decided to stop at Walterboro Airfield for fuel.

Local policy was that only 100 gallons or less of noncontract fuel be used due to the price differential. Therefore 100 gallons of jet fuel were requested and we assisted the attendant in refueling the UH-1. There were 100 gallons recorded on the pump register and we paid for it on a government civilian credit card.

As we proceeded through the checklist, after starting the aircraft, we noted that the fuel quantity gauge indicated only 275 pounds of fuel. This was the same indication that was on the gauge prior to our refueling. The gauge was retested, and it was determined that one of two things had occurred.

One, the UH-1 fuel indicator was defective. Or two, fuel did not go into the tank.

Since only 100 gallons of fuel were taken onboard it was impossible to verify physically that fuel did go into the tank. We both had seen

the 100 gallons register on the fuel pump and all visual indications were that the fuel went into the Huey. We knew that 100 gallons would easily carry us the 40 miles to our destination.

By now our time schedule was becoming critical. A delay would make us late picking up a colonel to fly him to the state adjutant general and his staff who were awaiting the colonel's arrival.

What would you have done?

We decided that safety was our first priority and returned to the gas pump. I contacted the attendant and insisted that he demonstrate that fuel was coming out of the nozzle. The attendant activated the nozzle and fuel poured out onto the ground.

I still was not convinced that the fuel went into the tank and requested that the attendant top the tank off so he could physically verify that the fuel was there. Mr. Lyell and I began the refueling process. Fuel flowed into the tank for a few seconds and then only air came out of the hose. *However the pump indicator still was registering that fuel was flowing into the tank.*

We managed to take on 50 gallons of gas and continued to Savannah for refueling.

Points of consideration:

- When taking on less than a full load, crosscheck for actual fuel flow with the pump meter and verify it with the UH-1 gauge.
- Take on a full fuel load when possible and physically verify that the gas went into the tank.
- When in doubt say, *safety first.*

EPMS CORNER

Enlisted Personnel Management System

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AIRCRAFT QUALITY Control Supervisor Course Military Occupational Specialty (MOS) 67W. School quotas are available for the aircraft quality control supervisor course at Ft. Eustis, VA. Applications are being accepted from personnel in grade E5 who have attained E6 promotion standing list status and personnel in grade E6 who are not in the zones of consideration for promotion to E7.

Personnel who will be due overseas tours in comparison with their contemporaries upon completion of school will not be allowed to attend in TDY and return status.

Applications will not be accepted from personnel who are on assignment instructions.

Soldiers serving in overseas areas who desire school training should apply approximately 8 months before their normal date eligible for return from overseas (DEROS). Applications should originate at unit level and be forwarded through channels to Military Personnel Center (MILPERCEN).

Enlisted Preference Statement (DA Form 2635). The enlisted preference statement has been revised to work in conjunction with Standard Installation/Division Personnel System (SIDPERS).

Soldiers who have completed a permanent change of station (PCS) move since they last submitted a preference statement should consider preparing a new one. The DA Form 2635 should be completed as accurately as possible and routed through the Soldiers' servicing Military Personnel Office (MILPO) to MILPERCEN.

Looking for an Exciting Career? Vacancies exist in the air traffic control field (MOS) 93H and 93J in grades E4 and E5.

Applications are being accepted from personnel on career status in grades E4 and E5 who are currently in an overstrength MOS.

Applicants for MOS 93H and 93J must possess a general technical (GT) or skilled technical (ST) score of at least 105 and be able to pass a class II flight physical. Prerequisities and school data are listed in DA Pam 351-4, formal school catalog. School application should be initiated at unit level and be forwarded through command channels to MILPERCEN.

Secondary Military Occupational Specialty (SMOS). Personnel in grades E6, E7, E8 and E9 are reminded of the requirement to be identified with at least one MOS in addition to their primary military occupational specialty (PMOS).

Personnel in grades E1 through E5 are encouraged to acquire an SMOS in order to permit greater use of skills. The SMOS may be awarded based on prior military service, civilian acquired skills or on-the-job training.

Personnel in all grades should not hold an SMOS which progresses into their PMOS. MOS qualifications are listed in AR 611-201 and 611-202.

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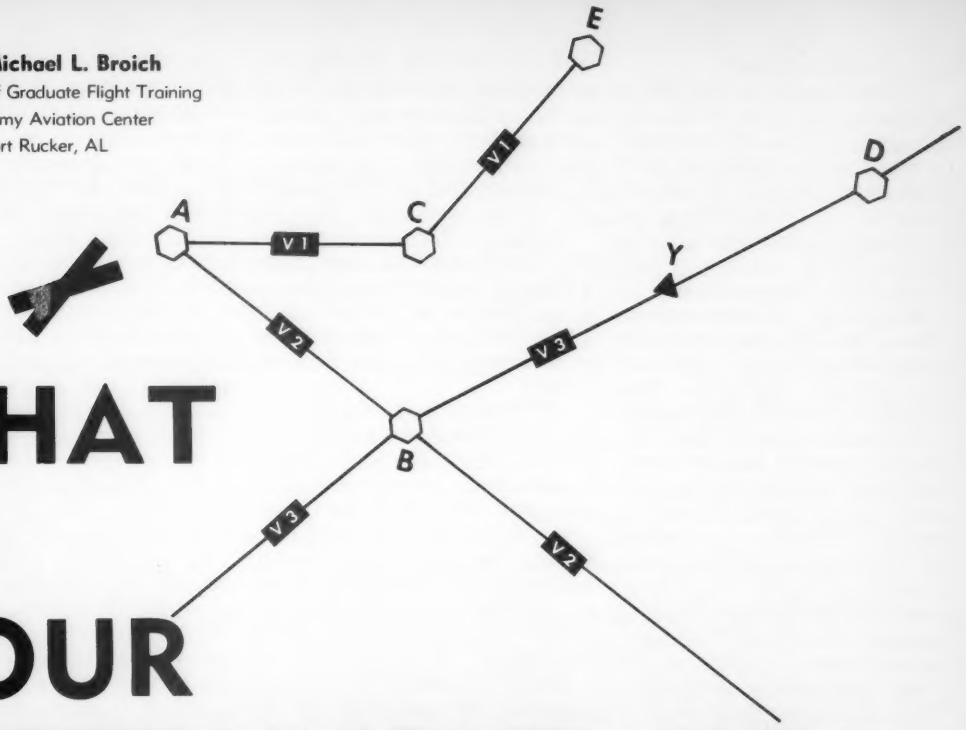

WHAT IS YOUR INSTRUMENT "IQ"

ALTHOUGH THE Night Hawk Program, NOE (nap-of-the-earth), tactical instruments and mid-intensity warfare are front and center in the Army aviation world, we all still are required to maintain proficiency in standard instrument practices and procedures.

The following is a little quiz to help test your instrument IQ. It poses 20 questions about stateside instrument procedures – some easy, some hard, some old, some new. All should be understood thoroughly. So take this little quiz – and come your next instrument checkride, you can impress your friendly neighborhood examiner. Answers and discussions begin on the following page.

1. You are issued the following IFR (instrument flight rules) clearance, "...cleared as filed, Hartford Two Departure, Cruise 5,000...." This is authorization for you to climb to 5,000 feet, proceed to the destination airport and descend and make an instrument approach without any further clearance. True or False?

2. Density altitude (DA) is as important for instrument operations as it is for VFR (visual flight rules) flights. Without using a density altitude chart or an E68 computer, figure DA from the following information: You are in your aircraft on the ground with a known field elevation of 500 feet. The current altimeter setting is 29.85 and the outside air temperature is 28 degrees centigrade. Density altitude equals _____.

3. An airport advisory area is the area under direct control of an airport control tower. True or False?

4. Refer to the following illustration. You have filed an IFR flight plan to "D" VOR (VHF omnidirectional range) via "A" VOR, V-1 to "C" VOR, direct "Y" intersection V-3 to "D" VOR. You are cleared to "Y" direct "A" VOR, V-2 "B" VOR, V-3 "Y" intersection maintain 7,000. The controller has provided you with enough information and you may take off without further clarification at this

time. True or False?

5. Refer again to the flight plan number four. With the same clearance you are told to "maintain 6,000, expect 4,000 at "C" VOR." If you arrived at "C" VOR with a lost communication situation, at what altitude would you proceed to "Y" intersection?

6. During an instrument checkride the examiner asks for and the tower approves an "option" approach. How will this approach terminate?

7. You contact the approach control facility serving your destination airport and you are issued the following information: "...cleared for straight-in ILS (instrument landing system) runway 36 approach, circle to runway 18...." a) This is a bad clearance as it is an obvious contradiction in terms. True or False? b) Are your minimums DH (decision height), straight-in LOC MDA (localizer minimum descent altitude), or circling MDA? c) Your missed approach point is (1) DH, (2) MDA or (3) MDA at time computed from ground speed and distance from the final approach fix?

8. The latest weather observation at your destination is M2OVC ¼ L-F, RVR (runway visual range) for the landing runway is 1,200 feet. Minimums published on the ILS approach chart are 582/24 (200-½). A pilot flying a helicopter is legally authorized to begin this approach, assuming it will terminate in a straight-in landing. True or False?

9. A VOT (VOR receiver testing facility) can be used at any point on or above the airport where a usable signal can be received. True or False?

10. On the low altitude enroute chart those VORs listed as "T" class are very rarely used to form Victor airways and only rarely are used to fix intersections. Why is this so?

11. You file a stopover flight with an IFR leg to an airport and 30 minutes ground time; the return leg is VFR. This is known as a composite flight plan. True or False?

12. You may not perform hooded flight (except in the OV-1) unless your observer is instrument rated in either category. True or False?

13. When filing a stopover flight plan, ground time at an intermediate stop will not exceed 2 hours, excluding air traffic clearance delay. True or False?

14. Flight Plan "Void Time," a mandatory entry for stopover flight plans, represents the time after ETD (estimated time of departure) that the entire flight plan will be cancelled if it is not activated. True or False?

15. Your aircraft is equipped with only one communication radio, a UHF (ultra high frequency) transceiver. Are you authorized to utilize a STAR (standard terminal arrival route) on an IFR flight plan?

16. When participating in Stage III radar service within a TRSA (terminal radar service area), you are provided separation from all aircraft within the area with which the controller is communicating, to include all VFR aircraft. True or False?

17. Decode the following teletype weather report:

LSF SP ø825-XM3 BKNE1øOVC1RW+237/75/ 68/33Vø312G21/ø23/R32VR4ø

18. If you are given a clearance limit short of your destination, air traffic control must, if they do not intend to issue you holding instructions, issue further clearance before you reach your clearance limit. They are not, however, subject to any time limit. True or False?

19. After breaking out at minimums on a circling VOR off-airport approach, you enter a left downwind for landing. During the circling maneuver, you again encounter IMC (instrument meteorological conditions) and make the decision to execute a missed approach. The published missed approach procedures specify a climbing right turn, return to the VOR and hold. You should (a) begin a climbing right turn, (b) begin a climbing left turn or (c) begin a climb and turn the shortest distance to a direct course to the VOR?

20. Helicopter approaches are designed based on straight-in minimums and therefore, in order to begin a copter approach, you must have only the visibility published on the approach chart. True or False?

ANSWERS

1. True. DOD FLIP, General Planning, chapter 2 (see "cruise" definition). A cruise clearance is also clearance for a pilot to execute a letdown and approach at his destination.

2. Density altitude equals +2,250 feet. FM 1-30, chapter 2. To figure DA without a chart or computer, solve the following equation: DA = PA + (120 x Vt) where PA is pressure altitude, 120 is the

temperature constant, Vt is the variation of OAT (outside air temperature) from the standard temperature at the pressure altitude. To solve, you must first determine PA by setting 29.92 in the Kollsman window of the aircraft altimeter. PA is then read directly from the altimeter. By raising the Kollsman setting to 29.92 from 29.85 (given) you increase indicated altitude to 570 feet. Therefore, PA = 570 feet. The next step is to determine the standard temperature at your actual altitude. Using the standard lapse rate of 2 degrees centigrade (C) per thousand feet, and a standard temperature of +15 degrees C at sea level, it is readily apparent that standard temperature at 500 feet is 14 degrees C. We now know:

Pressure altitude = 570 feet
Actual OAT = 28 degrees C
Standard temperature for PA = 14 degrees C
Temperature variation = +14 degrees C

Now solving the equation:

DA = PA + (120 x Vt)
DA = 570 feet + 120 x (28 degrees C - 14 degrees C)
DA = 570 feet + (120 x 14)
DA = 570 feet + 1,680
DA = +2,250

The factor of 120 is the approximate change in DA for each 1-degree C of temperature variation from standard.

3. False. DOD FLIP, General Planning, chapter 2 (see definition). An airport advisory area is the area within 5 statute miles of an uncontrolled airport on which is located a Flight Service Station (FSS).

4. True. DOD FLIP, General Planning, chapter 5. "ATC may utilize Short Range Clearance Procedures ...when any part of the route *beyond* the Short Range Clearance Limit differs from that specified in the original flight plan, clearance will include proposed routing beyond said clearance limit." Since the short range clearance takes you to a point in your flight plan route, further clearance is not required at this time.

5. 6,000. DOD FLIP, IFR Supplement, Procedures for Two-Way Radio Failures: In the event of a two-way radio failure, the pilot shall proceed at the *highest* of three altitudes: last assigned, the altitude you are told to expect or minimum enroute altitude.

6. You have no way of knowing. DOD FLIP, General Planning, chapter 2; AIM Part I, chapter 4. When cleared for an option approach, a pilot is authorized to make a touch and go, low approach, missed approach, stop and go, or full stop (7110.65, paragraph 420a, page 114).

7. a. False. DOD FLIP, General Planning, chapter 2. A straight-in approach (IFR) is one which is made without a procedure turn and has nothing to do with the landing runway.

b. Your minimums are circling MDA because this is a circling approach.

c. 3. MDA at time computed from ground speed and distance. See illustration.

8. True. AR 95-1, para 4-27c and 4-27d. "Helicopter pilots ...may reduce all published visibility or RVR by 50 percent, but never less than ¼ mile or RVR 1,200. RVR is the controlling visibility factor when published and reported for a given runway."

9. True. DOD FLIP, General Planning, chapter 5, para 5-52. "Adequate signal strength is present when the VOT identification is received and the VOR course warning flag is not in view."

10. Low Altitude Enroute Charts Legend. "T" class VORs have frequency protection guaranteed only up to 12,000 feet at 25 nautical miles. The low altitude enroute structure includes airspace up to but not including 18,000 feet. See L-8 Panel H, Enroute Low Altitude U.S. Chart, Alliance VOR V-100. In these cases a waiver is obtained to use a (T)VOR in the National Airspace System.

11. False. AR 95-1, para 4-11; AIM Part I, chapter 4. A composite flight plan involves IFR and VFR on the same flight, i.e., a VFR departure and an IFR arrival on the same leg.

12. False. AR 95-63, para 2-14c. "No aviator will engage in hooded flight unless he is accompanied by an *aviator* qualified and current in the category being flown and he is properly prebriefed for the flight."

13. True. AR 95-1, para 4-9c(2).

14. False. DOD FLIP, General Planning, chapter 4. "Void time" is the time as applied to actual takeoff time, that FSS will cancel proposed flight plans that have not been activated, that is, the second or any subsequent legs filed on the stopover flight plan.

15. No. DOD FLIP, General Planning, chapter 5. "Many of the FAA (Federal Aviation Administration) developed STARs do not provide sufficient routing or altitude information to allow orderly

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OPMS CORNER

Officer Personnel Management System

Major and Company Grade Aviator Management and Assignment Opportunities

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THE IMPLEMENTATION of Aviation as an Officer Personnel Management System (OPMS) specialty has raised many questions over the past several months. The new specialty is neither the harbinger of an "Army Air Corps" – as perceived by some – nor an amnesty program that is going to ensure success for all aviators. What the Aviation specialty does provide is a realistic aviator management framework that recognizes the impact of OPMS, the Aviation Career Incentive Act (ACIA), current strength imbalances and projected training rates. Last month's article discussed the philosophy and rationale that led to the establishment of the Aviation specialty as well as requirements and considerations for those interested in entering the aviation program. This month we address aviator management and current assignment opportunities for majors and company grade aviators in specialty 15. Information on senior field grade officers will be presented in later articles.

The Aviation specialty (15) encompasses operational and nonoperational flying positions concerned with the employment and support of Army aviation units and elements, less those identified with Research and Development Experimental Test Pilot (51C), Army Medical Department (AMEDD) (67J), and Aviation Materiel Management (71A). Due to the wide variety of positions found within the specialty it is being further defined with four specialty skill identifiers (SSI): 15A – General Aviation Officer; 15B – Combat Aviation Officer; 15C – Combat Support Aviation Officer; and 15D – Combat Service Support Aviation Officer. Figure 1 shows samples of positions identified by each SSI. *It is important to note that these SSIs identify positions, not people.* The SSI gives the force developer a more accurate means of identifying position requirements and will assist Officer Personnel Management Directorate (OPMD) in providing a qualified officer capable of performing the job. The new SSIs are contained in Change 3 of AR 611-101 which is scheduled for distribution to the field by June 1977.

As originally implemented the aviation specialty was designated at the officer's eighth year of commissioned service as either a primary or alternate specialty. Year groups (YG) 69 and earlier have been designated under this procedure and YG 70 is scheduled for completion in late April of this year.

The recent approval of event oriented designation procedures changes the designation point for the Aviation specialty. This concept provides that officers will be designated with an appropriate alternate OPMS specialty upon completion of initial entry flight training and graduate level civil education. Consequently, officers (other than AMEDDS and members of the Aviation Materiel Management specialty) will be designated with an alternate specialty of 15 upon completion of initial entry flight training. Records of aviators in officer YGs 71 and later have been corrected to reflect this change.

Specialty designations for all officers will be reviewed and validated during an officer's seventh year of federal commissioned service and redesignations made as

Aviation Specialty Positions

15A - General Aviation Officer
Nontactical (TDA) Aviation Unit Commander
Airfield Commander
Aviation Staff Officer
Airfield Operations Officer
Aviation Safety Officer (ASI 1S)
Aviation Unit Advisor (ASI 5T)
Readiness Coordinator
R&D Coordinator
Instructor, Aviation School
S-1, Aviation Battalion/Squadron/Group/Brigade

15B - Combat Aviation Officer
Combat Aviation Battalion, Group or Brigade Commander/XO
Assault Helicopter Unit Commander/XO
Air Cavalry Troop/Squadron Commander/XO
Aerial Field Artillery Battery
Battalion Commander/XO
Attack Helicopter Company/Battalion Commander/XO
Aviation Platoon/Section Commander
S-3 Combat Aviation Battalion/Group or Brigade
Aviation Staff Officer (Division level and lower)

15C - Combat Support Aviation Officer
Air Traffic Control Unit Commander (ASI 3J)
Aerial Surveillance Company Commander
ASA Company (Aviation) Commander
Aviation Platoon/Section Commander
S-2, Aviation Battalion, Group or Brigade
Communications - Electronic Staff Officer
Aviation Battalion, Group or Brigade

15D - Combat Service Support Aviation Officer
Assault Support Helicopter Company/Battalion Commander
Aviation Platoon/Section Commander
S-4 Aviation Battalion/Group or Brigade

Figure 1

necessary at the eighth year to meet Army field grade requirements. It now appears that requirements will demand that most aviators in YGs 71 and later will have Aviation designated as one of their specialties at this point. Most of these officers will be highly qualified for a primary designation of Aviation at the eighth year point. Those so designated will pick up a new alternate specialty. Recognition of former primary specialty skills will be retained in the officer's master file as a previously designated specialty.

When aviators with *less* than 8 years service are not in specialty 15 positions they normally will be assigned to duties which will increase their experience in their primary specialty or to positions which will provide developmental experience in an alternate specialty.

Once aviators pass the eighth year formal designation point they normally will be assigned duties in one of their two designated specialties just as are their nonrated contemporaries.

Army requirements will continue to demand that officers sometimes will be assigned outside of their designated specialties. We can expect that aviators will fill their fair share of positions which are not specialty related such as Reserve Officers' Training Corps (ROTC) or recruiting. There also will be occasions when officers will be assigned to previously designated specialty duties. In these cases an effort will be made to assign the officer to a location which also provides an opportunity for Aviation or alternate specialty development during a stabilized tour. As OPMS develops the proper number of qualified officers for each specialty the need for assignment outside their designated specialties will diminish.

Up to this point most of the discussion has centered on the designation process and assignment policies. Where can company grade aviators expect to serve in the Aviation specialty?

Lieutenants graduating from initial entry training can expect to be assigned to a 3-year utilization tour in an operational flying position. The bulk of these positions are in table(s) of organization and equipment (TOE) units, where they can expect to serve as a team or section leader. Figure 2 shows a general breakdown as to the location of requirements. A concerted effort is being made by Deputy Chief of Staff for Operations and Plans (DCSOPS) and Military Personnel Center (MILPERCEN) to eliminate or convert to warrant officer those commissioned officer positions shown as "Pilot or Aviator." If

a position calls for a commissioned officer it should entail specific supervisory or staff responsibilities.

Utilization tours for captains graduating from initial entry training also normally will be to tactical units. Due to the current shortage of lieutenants some captains initially may be assigned to team or section leader positions. Most, however, will be assigned as platoon leaders or in unit operations duties. Many other positions require captains; however, these are to the extent possible filled by aviators who have experience in aviation units. Examples of these duties include command of detachments and aviation battalion headquarters companies as well as functional staff positions at aviation battalion and group level. Captain specialty 15 positions, are found in all but one of the Army Readiness Regions and on the Continental United States (CONUS) Army headquarters staffs. There is a large variety of captain duty positions at the U.S. Army Aviation Center at Fort Rucker, AL, and at several other Training and Doctrine Command (TRADOC) installations. Army Materiel Development and Readiness Command (DARCOM) and U.S. Army Communications Command (USACC) also have specialty 15 positions for captains.

Most of the approximately 135 company and detachment command positions in the Aviation specialty are found at the grade of major. The number of commands varies somewhat with tables of distribution and allowances (TDA) and TOE changes. With the implementation of the Aviation Requirements for Combat Structure of the Army Study (ARCSA III), we will see fewer detachments in the system and more combat aviation units, with a corresponding increase in tactical unit command opportunities.

AVIATION SPECIALTY REQUIREMENTS BY COMMAND

	LT	CPT	MAJ
USAREUR	23%	11%	14%
Eighth Army	10%	6%	5%
FORSCOM	62%	51%	52%
TRADOC	2%	24%	18%
Other Major Commands	3%	8%	11%

Figure 2

As can be seen in figure 2 the proportional requirements by command do not change significantly from captain to major. The primary difference is the shift from unit level requirements to staff responsibilities. In combat aviation units requirements are for battalion and squadron executive officers and S-3s. Functional staff positions are found in the four aviation groups and the 6th Air Cavalry Combat Brigade (ACCB). All nine Army Readiness Regions have requirements for aviation advisors in the grade of major.

Aviation staff officer positions are found at every level of the structure from brigade to Department of the Army. There also are worldwide requirements in Army Military Assistance Advisory Groups (MAAGs) and missions. Aviator majors also serve in a variety of positions to include instructors, project officers and staff officers throughout the TRADOC school system.

Any discussion of assignment opportunities must by necessity be broad. The variety of assignments available to members of the aviation specialty are as varied as any specialty within OPMS. Current position requirements for members of the Aviation specialty are 871 lieutenants, 1,441 captains and 490 majors. These are all operational flying positions. Upon implementation of Change 3 to AR 611-101 in the fall of this year, nonoperational flying positions for about 150 captains and 100 majors will be shifted from other specialties to specialty 15.

More information on specialty 15 will appear in the revised edition of DA Pamphlet 600-3, "Officer Professional Development and Utilization," which is scheduled for publication this fall.

As pointed out, implementation of Aviation as an OPMS specialty will not change the role of the Army aviator. Our mission of augmenting the capability of the Army to conduct prompt and sustained combat operations on land remains the same. In the present and future environment of reduced strengths, stabilized tours, and changing Army requirements, the Aviation specialty provides a realistic framework for managing the professional development and utilization of the Army aviator.

New Guy Goes IMC

Continued from page 7

manner, and ground control approved our shutdown at that position.

After we completed the shutdown and tied the rotors down, the CE refueled the aircraft. The medics called the hospital to check on the sergeant and reported that he was admitted for treatment. Doc suggested that we get a cup of coffee and some food before we returned to Grayling. So we walked over to the restaurant and treated the CE and medics to a little snack.

Prior to departing I checked the weather with the Saginaw FSS, filed a flight plan and cleared the area. We climbed to 4,500 feet mean sea level (MSL) and settled down to an early morning flight back to Grayling. Stars and the Moon provided a spectacular show for us, and even an occasional shooting star was spotted.

The medics soon were sleeping, and we entered into a discussion on the differences between the tanker's helmet and the SPH-4, and how a helmet may have helped lessen the sergeant's injuries. About 5 miles south of Grayling, Doc descended from 4,500 to 3,500 feet MSL and then to 3,000 feet MSL. We were to land at the lighted pad to drop off the medics before returning to the airfield, as they had a short walk to their quarters.

I called OPS on FM, gave our position, and informed them of our intentions. I asked this OPS officer about the weather, because suddenly we had no stars or Moon and could see patches of ground fog in the low areas. OPS assured us that there were no restrictions to visibility, and the stars and Moon were out over the airfield.

Doc was at the controls and I was looking at my approach plates, tuning in the nondirectional beacon (NDB) which was northwest of the airfield. In just a matter of seconds we were instrument meteorological conditions (IMC) at 3,000 feet MSL. Doc attempted a 180-degree turn to the left to get back VFR and in the clear. I wasn't aware of being IMC as I was fine tuning the NDB.

In his turn to the left (he was sitting on the left) Doc suddenly got vertigo and put us into an unusual attitude. I still didn't realize it, as I was concentrating on getting that NDB tuned in.

All Doc did, or said to me, was "take it," and I looked up. My hair must have stood on end because I saw nothing out the window except the reflection of our navigation lights off the "not-so-clear air anymore."

In flight school my instructor stressed unusual attitude recovery, and to him anything less than perfect wasn't good enough.

I got my cross-check going in what must have been only seconds. I went on instruments and began correcting our attitude in an attempt to regain positive control of the aircraft. Some of the variables worth mention were:

- Left turn in excess of 60-degree bank
- Vertical speed indicator 1,500 feet per minute plus up
- Airspeed 40 knots
- Torque — uncertain
- Pitch — 40 degrees up

It took me about 10 to 15 seconds to sufficiently recover. I might add, that the transfer of controls was *not* in the proper, positive nature required for a safe transfer. We were under positive control by the time we were at 4,000 feet MSL, and I shudder to think what would have happened if a descent occurred. Terrain in all quadrants around Grayling rises to 1,300 feet.

I called OPS again and informed them I was IMC, on a heading of 180 degrees, and checked again on their weather. Again the same reply, no clouds or fog, clear all around. After 2 or 3 minutes, and still IMC at 4,000 feet MSL, we couldn't figure it out.

With plenty of fuel for an hour, out came the maps and plates. Then Doc said he saw the Moon. I climbed a couple hundred feet, and we were in the clear again. To the north we could see the lights of Grayling, and the airfield's rotating beacon. Also, we could then see what we were in.

The cooler air in the early morning had blown across Lake Margrethe, which is located between the main camp medevac helipad and the airfield, and its associated swamps and low lands. Fog was formed over a large area, estimated to be 5 miles wide, and 5 miles long, extending up to 4,000 feet MSL.

We flew east to skirt the fog and landed without further incident. OPS couldn't believe that we were IMC, but after a look at our CE and the medics I think he was convinced.

I closed out with FSS (gave notice of the fog), and arranged for transportation for the medics back to their quarters. A lesson learned about night VFR is that IMC can sneak up on you if both "jocks" up front are not working together.

Doc is getting his instrument ticket now, and I try to get in as much "hood" time as I can, and use my unit instrument instructor pilot (IP) to the fullest extent possible, mission requirements permitting. Neither of us travel on training flights without complete, current flight information publications (FLIPs), and practice instrument approaches despite it being VFR.

I M C — never again with my guard down!

Continued from page 3

in a chin-mounted turret. A new missile, with a maximum range of about 10 Km (6.21 miles), is under development for the helicopter.[16]

The Mi-24 with its heavy armament coupled with its ability to carry 8 to 12 soldiers certainly is representative of Russian helicopter technology. Not only will this aircraft be able to support its own troop insertions, but it also will be used against armor and in a general close air support role.[17] Even without considering that the Hind may have a radar-directed 23 mm cannon, this helicopter poses an awesome threat to helicopters it would engage in combat.

A third helicopter which might be employed in an airmobile role is the Kamov Ka-25 Hormone. This helicopter serves primarily in an antisub warfare (ASW) role aboard the Soviet Navy helicopter cruisers. It is powered by two 900 hp turbine engines, can carry 12 passengers and is armed with various ASW weapons.[18]

Soviet Airmobile Tactics

Until the 1960s the Soviets considered paratroopers to be the ideal force to be used in the "airmobile" role. But the realization that troops from motorized divisions could be trained quickly and airlifted with all their equipment led to the establishment of the motorized rifle battalion (MRB) in this role. A very complete article by Lyutov and Sagaydak, "The Motorized Rifle Battalion In A Tactical Airborne Landing," discusses the various roles; conditions of employment; and principles of the conduct of combat action in enemy rear areas. The article also details methods of loading equipment and personnel on helicopters. It states that although the reinforced MRB usually will be used for the various operations described, smaller units may be employed and the reinforcement of the MRB will vary depending on the mission.[19] The authors stress the importance of the MRB landing together with its armored personnel carriers and reinforcing weapons in order to assure the swift movement to the objective.[20]

The MRB will be assigned flythrough zones over friendly and enemy troops enroute to its objective. Where possible, the heliborne force would attempt to fly over terrain not occupied by the enemy. But failing that, enemy troops will be neutralized by artillery or tactical air support or by the use of nuclear fires. Fighter plane cover can be expected to support the entire operation.

The rear element of the enemy will be subjected to a number of different missions which have been proposed for this airmobile force. An important point to consider is the seizure of river crossing sites ahead of advancing Soviet units. This capability was underscored by a *PRAVDA* report on exercises in the Dvina maneuver region in 1970:

...a large group of helicopters suddenly appeared from behind a wooded area. Laying down a concentrated machine-gun and automatic weapons fire under fighter protection, the choppers carried out an airborne landing against which the "South" was forced to commit tanks. This landing by the "North" played a significant part in forcing the rivers.[21]

Other objectives of Soviet airmobile operations will be to:

- *Delay entry of enemy reserves.*
- *Destroy enemy nuclear weapons.*

An Mi-6 "Hook" can carry up to 65 combat equipped soldiers. Wings were added to later models providing about 20 percent of the total lift

Mi-10 "Harke" appears similar to our CH-54 Skycrane. The Mi-10 was developed after the Mi-6 (background). Note their upper fuselage likeness. Large external pods are fuel tanks

- *Disrupt enemy command communications.*
- *Occupy vital areas (i.e., key road junction, mountainpass, etc.).*[22]
- *Sieze beachhead (in this respect it is interesting to note that the Hind A has been proposed as a candidate for employment aboard the new Soviet aircraft carrier Kiev).*[23]

And what are the capabilities of this force once it is landed in the enemy rear? Basically, the Soviets believe that an MRB – reinforced with 122 mm artillery, 120 mm mortars, and mounted in its carriers – could inflict heavy damage on the enemy and exist with or without supporting artillery and close air support for a number of hours (in Turbiville's opinion, up to 24 or 48)[24] before linkup.

The Soviet Armed Forces preoccupation with the violent, swift attack and the importance placed on the principles of mobility, surprise, combat activeness, massing and dispersion of forces (so necessary on a nuclear battlefield)[25] all combine to indicate that helicopters and airmobile tactics are becoming increasingly more important to the Soviet Union. Further, technological weaknesses hinder the Soviet fighter planes' all-weather operational capability and thus increase potential reliance on helicopter gunships for close air support.[26]

The Soviet airmobile threat now is numerically inferior when compared to NATO but its inventory is increasing at a tremendous rate.

The U. S. Army must pay much more attention to the potent threat posed by Soviet airmobility. Although the threat is of manageable proportion now, we must fully comprehend it and emphasize serious training to combat this threat.

The U. S. Army must continue to modernize its helicopter fleet and ensure that it is not outflanked either in numbers or in technology.

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4. Brigadier General Dr. F. M. von Senger und Etterlin, "The Air Combat Troops," *Military Technique*, vol. 12, 1971, as quoted in Wiaroa, "The Tank."
5. For examples, see M. Belov "Air Mobilization of Modern Armies," *Soviet Military Review*, October 1975, and I.S. Lyutov and P. T. Sagaydak, *The Motorized Rifle Battalion in a Tactical Airborne Landing* (Moscow Military Publishing House, 1969). Hereafter referred to as Lyutov and Sagaydak.
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22. A. A. Sidorenko, *The Offensive (A Soviet View).* Translated and published under the auspices of the U.S. Air Force (Washington, DC: U. S. Government Printing Office, 1970).
23. Norman Polmar, "The Soviet Aircraft Carrier," *U. S. Naval Institute Proceedings*, Naval Review 1974.
24. Turbiville, "A Soviet View."
25. For a discussion of these principles, see V. Y. Savkin, *The Basic Principles of Operational Art and Tactics (A Soviet View).* Translated and published under the auspices of the U.S. Air Force (Washington, DC: U. S. Government Printing Office, 1974).
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PIPELINE

"ROGER THAT"

THE PIPELINE survey sheets have stopped coming in the mail. So, as one captain wrote on his sheet, we'll "put the tally out."

The *DIGEST* again received a solid endorsement from its readers. In fact 97.4 percent found the magazine helpful or interesting (or both). This showed a slight improvement over the 97.3 percent received in the last survey (see September 1974 *DIGEST*).

This time 307 survey sheets were returned. This is less than in 1974, but percentage wise it is in proper proportion to the reduced number in the reading audience and to the survey sheets distributed.

Here is how you checked the first portion of the survey (helpful, interesting or ugh):

- 79 percent felt the *DIGEST* helped them in their work and checked helpful (that's up from 74 percent in the last survey).
- 56 percent thought the *DIGEST* was interesting and checked interesting (up from 50 percent).
- 38 percent checked both the helpful and the interesting spaces (up from 27 percent last time).
- 3 percent did not like the *DIGEST* and checked ugh. (We did not improve here. Last time only 2 percent checked ugh.)

The ughs (there were eight) are of concern. These should quickly point out weak areas that need attention. Of the eight ughs received, five were pretty much out of step with the feelings of their peers. But three – all E-6 maintenance types, by the way – agreed that the *DIGEST* does not devote enough attention to enlisted personnel or maintenance. We have been working to offset this. We already have begun a regular EPMS Corner and also are planning expanded maintenance coverage with an accent on articles written "by maintenance men for

Overall

I prefer articles on:	Same	More	Fewer
Avionics	52%	15%	12%
Armament	44%	14%	19%
ATC	35%	34%	6%
Inst. Flying	23%	56%	4%
Humor	39%	27%	12%
Maintenance	36%	46%	7%
Medical	41%	18%	17%
Research	37%	41%	8%
Developments	30%	50%	6%
Safety	33%	51%	7%
Tactics	32%	33%	17%
History	36%	19%	25%
Training	33%	42%	8%
Combat Exp.	32%	24%	26%
Weather	35%	44%	3%
Accidents	32%	49%	3%
Flying Exp.	37%	41%	7%

Officer

I prefer articles on:	Same	More	Fewer
Avionics	57%	11%	16%
Armament	49%	17%	18%
ATC	35%	50%	3%
Inst. Flying	18%	73%	2%
Humor	47%	23%	17%
Maintenance	43%	41%	8%
Medical	41%	17%	25%
Research	34%	35%	18%
Developments	34%	47%	9%
Safety	36%	47%	10%
Tactics	32%	41%	14%
History	36%	12%	37%
Training	33%	48%	8%
Combat Exp.	34%	27%	28%
Weather	40%	47%	1%
Accidents	35%	49%	6%
Flying Exp.	39%	41%	9%

Warra Offi

I prefer articles or	
	Sam
Avionics	2%
Armament	3%
ATC	7%
Inst. Flying	1%
Humor	9%
Maintenance	3%
Medical	9%
Research	7%
Developments	2%
Safety	6%
Tactics	1%
History	7%
Training	5%
Combat Exp.	9%
Weather	1%
Accidents	1%
Flying Exp.	7%

maintenance men." That quote is from one of the E-6s who graded the *DIGEST* ugh – and then really gave us an F minus by writing "very much so" behind the ugh.

This is the first year anyone has written comments to emphasize their feelings in this portion of the survey. We're glad that was the only F minus, and also are happy that 15 (another first) gave us A pluses by marking extra endorsements behind helpful or interesting – or both. The A plus markers included Department of the Army civilians, officers, warrants, enlisted and a National Aeronautics and Space Administration research pilot.

The charts below speak for themselves about how you feel about subject matter coverage. The "overall" chart has not changed significantly from the last survey.

Most readers were quite complimentary of the *DIGEST* in the comments section. "Ditching The Huey" from the November 1976 issue was singled out for praise. So was "The 5C Recipe For Inadvertent Soup" from the October 1976 *DIGEST*.

Many praised ATC Action Line and the *DIGEST's* corner series (Dash 10 Corner; Instrument Corner; OPMS Corner; and EPMS Corner). There were recommendations for an Allied Corner; a Contact Flying Corner; and a Reserve Components Corner. We are looking into these possibilities.

A great many asked specific questions and gave their names and addresses. Those who have not heard from us yet, please be patient; it's going to take a bit longer. Those who asked specific questions, watch the Views From Readers' column. We will try to print answers to all of the querries in the VFR.

Again this year many read-

Continued on page 29

Officer

s or			
	ame	More	Fewer
	2%	21%	12%
	3%	11%	25%
	7%	44%	5%
	1%	65%	4%
	3%	32%	9%
	3%	46%	9%
	8%	26%	19%
	7%	43%	3%
s	2%	47%	5%
	8%	49%	4%
	5%	35%	18%
	7%	25%	25%
	3%	43%	11%
	1%	23%	34%
	3%	51%	4%
	1%	56%	6%
	1%	44%	7%

Enlisted

I prefer articles on:			
	Same	More	Fewer
Avionics	45%	13%	10%
Armament	34%	21%	11%
ATC	29%	27%	11%
Inst. Flying	34%	16%	11%
Humor	32%	26%	8%
Maintenance	21%	63%	2%
Medical	34%	21%	5%
Research	31%	42%	2%
Developments	18%	56%	2%
Safety	16%	63%	3%
Tactics	29%	26%	13%
History	32%	27%	15%
Training	37%	31%	10%
Combat Exp.	31%	29%	11%
Weather	27%	31%	6%
Accidents	31%	42%	2%
Flying Exp.	37%	31%	5%

Civilian

I prefer articles on:			
	Same	More	Fewer
Avionics	50%	17%	4%
Armament	33%	4%	29%
ATC	38%	38%	4%
Inst. Flying	33%	33%	4%
Humor	38%	29%	8%
Maintenance	38%	29%	8%
Medical	42%	21%	8%
Research	33%	50%	4%
Developments	29%	54%	4%
Safety	33%	54%	0%
Tactics	38%	8%	25%
History	42%	13%	17%
Training	29%	46%	8%
Combat Exp.	33%	25%	21%
Weather	50%	29%	0%
Accidents	38%	38%	4%
Flying Exp.	42%	29%	4%

Behind The Hind

Continued from page 5

effect up to 7,200 feet. No information regarding the Hind's single engine performance capabilities is yet available.

Unlike the United States, the Soviets assign all their land based aerial vehicles to the Air Force. Therefore, in the case of the Hind, it normally would be found in an autonomous helicopter regiment as part of a Soviet Frontal Aviation Army. The regiment usually contains 50 to 55 aircraft of which 40 are in an operational posture.

One Soviet Frontal Aviation Army normally is assigned to the commander of a Front (2 to 7 Armies, each consisting of 3 to 4 divisions) and represents the totality of his immediately available tactical air support. As an example, the 16th Frontal Aviation Army stationed in the German Democratic Republic comprises more than 1,200 aircraft and contains 2 to 3 helicopter regiments (the exact number is uncertain) equipped with the Hind.

The Hind, because of its dual role as both a gunship and a troop carrier, represents a departure in mission design from Western efforts which have habitually separated the two. The advantages of such a consolidation from a maintenance and supply standpoint are readily apparent, but the tactical mission benefits merit additional comment.

As Colonel M. Belov, one of the Soviet Union's more prolific writers on airmobility, pointed out in a recent article, helicopters with the Hind's design characteristics can be used to airlift forces and weapons directly to the battlefield. They can provide enroute fire support and, on arrival at the objective, they are available immediately as an adjunct to the soldiers' other weapons. They may be used to destroy tanks, other armored targets, aircraft (both inflight and on the ground) or for normal utility missions such as resupply, medevac, command and control, and liaison.

Specific missions which are likely candidates for airmobile operations employing the Hind include seizure of critical terrain features such as road junctions, mountain passes, river crossing sites or bridges. Other possible targets include nuclear storage sites, communication facilities and forward logistical support facilities. The element of surprise employed in conjunction with a small highly mobile strike force incorporating devastating firepower is a potentially lethal combination and one very difficult to guard against.

It should be obvious from the foregoing that the Soviets have learned well from the experiences of others concerning the potential advantages of tactical helicopter utilization. With more than 100 Hinds deployed as of January 1976, and the number steadily increasing, there is ample cause for concern. A squad carrying helicopter with antipersonnel, antitank and antiair gunship capabilities is a potent weapons system and poses a significant threat in any tactical situation.

...the Soviets have devoted great effort to studying the tactical successes of Western armies and applying those lessons...

VIEWS FROM READERS

Sir:

I am gathering material for a story on the World War II bombing and destruction of the Abbey of Monte Cassino during the Campaign in Italy, February 15, 1944 and need some information.

One of the dramatic highlights of the story is the flight of Generals Eaker and Devers, who flew over the Abbey in a Piper Cub 2 days before the bombing to ascertain whether or not the Germans were inside. (See Craven & Cate, *AAF In WWII*, volume 3, page 362.)

I am seeking information not only on this particular flight but also on the use of light planes in the Battle of Cassino around that time – especially in regard to reconnaissance work in and around the Abbey prior to bombardment.

An article in the November 1962 *DIGEST* by Richard K. Tierney, "The Army Aviation Story – The War Years," part VI, pages 34-47, mentioned (on page 45) a Captain Marinelli as II Corps Aviation Officer on the Cassino front. Is he still around where I may contact him?

Also, if there is anyone who may have had direct knowledge of the Abbey incident or may lead me in obtaining further information on this, I would appreciate it.

Thank you very much for your kind attention and I look forward to hearing from you.

David W. Richardson
11240 Oak Street
Kansas City, MO 64114

Anyone who feels they have information that may help Mr. Richardson is urged to contact him at 11240 Oak Street, Kansas City, MO 64114.

Sir:

In the article "Crash Helmet or Head Set," which appeared in the February 1977 *DIGEST*, the author refers to the "inspection shop." I am not being cynical when I say, "what inspection shop?" The author in his narrative is recommending the correct action even though the Army doesn't have life support equipment (LSE) technicians or organized LSE maintenance shops of any quality. All due respect is given to post personal equipment pools. The subject of LSE in the Army is timely and of great interest to aviators.

COL Stanley C. Knapp, M.D.
Dir, Bioeng & Life Spt Equip Div
U.S. Army Aeromedical
Research Lab
Ft. Rucker, AL

Aviation Training Programs For 1977

THERE ARE SOME new wrinkles in training courses for Army aviators at the U. S. Army Aviation Center, Ft. Rucker, AL, in 1977, according to Department of the Army (DA) officials.

For starters, the initial entry rotary wing (IERW) training program will be revised starting in June. The program will stress night and combat skill-related training. It will include a dual tracking feature in which about 25 percent of the students will be qualified as OH-58 Kiowa aeroscout pilots. Students will receive the self-paced mode of instruction in all phases of the course. Also, greater reliance will be placed on simulator use. The course is designed to improve battlefield survivability and effectiveness of the combat soldier.

DA officials said that in addition to the IREW program, Training and Doctrine Command (TRADOC) program planners at Ft. Monroe, VA, also will establish an aviator refresher course. This will allow officers to brush up on aviator skills and update their knowledge. Officers returning to flying duty after serving 3 or more years in a nonoperational flying assignment will attend. The first refresher course is set for April.

Also, an aviation commander's readiness course has been designed for aviation unit commanders and key staff officers. They will receive instruction on management and use of aviation resources.

Radio Silence

Continued from page 9

(revolutions per minute).

Extended Idle. If time remains before takeoff the lead navigator/crewchief, on command of flight lead, will signal extended idle by crossing arms below the waist during the day. At night the signal will be two flashlights turned on above the head and brought down below the waist, turned off and repeated.

Operating RPM. Two minutes prior to takeoff, on command of flight lead, the navigator/crewchief will signal operating RPM by raising arms above the head. At night the signal will be two flashlights turned on below the waist and brought up over the head, turned off and repeated. After this has been accomplished, the navigator/crewchief will enter the aircraft.

Pitch Pull Alert. Fifteen seconds prior to takeoff flight lead will signal by turning on the anticollision light.

Pitch Pull. Flight lead will turn the anticollision light off immediately prior to takeoff.

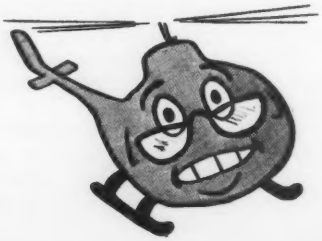
Formation Change. If a change of formation is to be accomplished enroute, an aerial checkpoint will be designated to alert crews. When crossing the checkpoint, the flight lead will turn on the anticollision light for 15 seconds as a warning. Flight lead will turn the anticollision light off when the formation is to change. If the formation is large and in straight trail, each aircraft can relay the signal. More time must be allowed to compensate for the lag in relay of signals.

Change Of Mission. If for any reason the intended landing point is changed after the formation is airborne and a suitable ground coordination point is not available, flight lead will signal by turning the navigation lights to flash bright for 1 minute. This will alert all flight crews to the change in mission and even though individual aircraft do not know the exact change, all crewmembers will know that the mission is to be modified and will be alerted.

Aircraft Unloaded. If the LZ is cold, each navigator/crewchief can exit and give a thumbs-up signal when the aircraft is unloaded and ready for takeoff during daylight hours. At night one flashlight can be waved vertically as the signal. If the LZ is hot, coordinate departure over the radios.

One factor affecting the success of radio silence missions is supporting fires. If artillery supporting fires are to be used without radio communications, coordination is necessary to ensure shifting of fires at exact times, and that all elements of the airmobile adjust enroute to cross checkpoints on time. If helicopter gunships are to be used, they can accompany the formation in the conventional manner, and remain on call on mission frequencies should enemy contact be encountered. If gunships are to provide suppressive fires, it is essential that preplanned sectors be assigned which do not conflict with approach and departure paths. Enemy contact in the LZ is sufficient grounds for breaking radio silence to shift suppressive fires. Preplanned air strikes must be coordinated to end prior to the formation final approach. The U. S. Air Force liaison officer must be supplied with exact checkpoint times to ensure timely use of high performance aircraft.

Duties Of Command And Control. A command and control aircraft can be used effectively at terrain flight altitudes. This element can coordinate last-minute changes to the mission with ground and air elements and ensure dissemination of these changes at predesignated ground coordination points. During the test flight phase of these techniques, it was found that when the command and control aircraft was equipped as a smoke ship,



VISUAL

...upon return to visual conditions, if the mission is to be continued, the formation should return to radio silence...

EMERGENCY

...an aircraft down due to enemy fire or maintenance would require radio silence be broken to return the crew and aircraft to safety...

it could be used very effectively to mark LZs and restrict enemy visibility through smoke screens. Should enemy contact be encountered and radio silence broken, command and control can be used in the conventional manner to exercise overall mission control.

There are some conditions which require radio silence to be broken, such as:

- When unexpected instrument meteorological conditions (IMC) are encountered enroute, it is necessary to exercise positive control of the formation so that breakup procedures can be implemented.
- When the formation returns to VFR (visual flight rules) conditions and if the mission is to be continued, radio silence procedures should again be adhered to.
- Downed aircraft, either from enemy fire or maintenance problems, require radio silence to be broken so that the safe return of the crew and aircraft to friendly control is assured.

Radio transmissions should be kept to minimum essential so that the formation location is not compromised. Radio silence in the LZ once enemy contact is made serves no purpose. Transmissions must be made to pinpoint enemy locations and to coordinate covering fires. It should be stressed, however, that once a flight removes itself from the location known to enemy forces, it can deny that enemy knowledge of the flight location by again practicing radio silence procedures in conjunction with terrain flight altitudes.

The planning sequence and many of the signals mentioned in this article were tested on students attending the Initial Entry Rotary Wing Program at the U.S. Army Aviation Center at Fort Rucker, Alabama. The students displayed a surprising ability to grasp the techniques and function effectively as an airmobile element in radio silence. The real problem lies in educating experienced aviators who have long used the radio as an extension of themselves while conducting airmobile operations.

The basic problems and solutions to radio silence operations have been presented to help create discussion and exchange of information about airmobile operations under radio silent conditions.

Individual aviation units should develop SOPs which fit their particular mission and practice these procedures until they become second nature. And they should send their ideas, procedures and comments to the *AVIATION DIGEST*.

Pipeline

Continued from page 25

ers asked for a larger *DIGEST* with more pages and color. Also many do not know how to get the *DIGEST* and one of the biggest complaints is that they cannot get enough copies. The *DIGEST* is on pinpoint distribution. The inside front cover tells you how you can obtain the magazine.

In a breakout by jobs, instructors and pilots mostly want more on instrument flying, training and developments. Maintenance personnel (77 percent) want more maintenance while 77 percent of the commanders want more instrument flying. Safety officers (78 percent) want more safety. But, the breakout by jobs also adds up to individuals wanting the same or more of every category. Only a few want less of any category. As with the last survey, combat experience is the category that drew the most "fewer" votes. But even that is a minority.

The *DIGEST* is always glad to hear from you. If you have any questions or suggestions, send them to Editor, *U. S. ARMY AVIATION DIGEST*, P. O. Drawer P, Ft. Rucker, AL 36362 or call AUTOVON 558-6680.

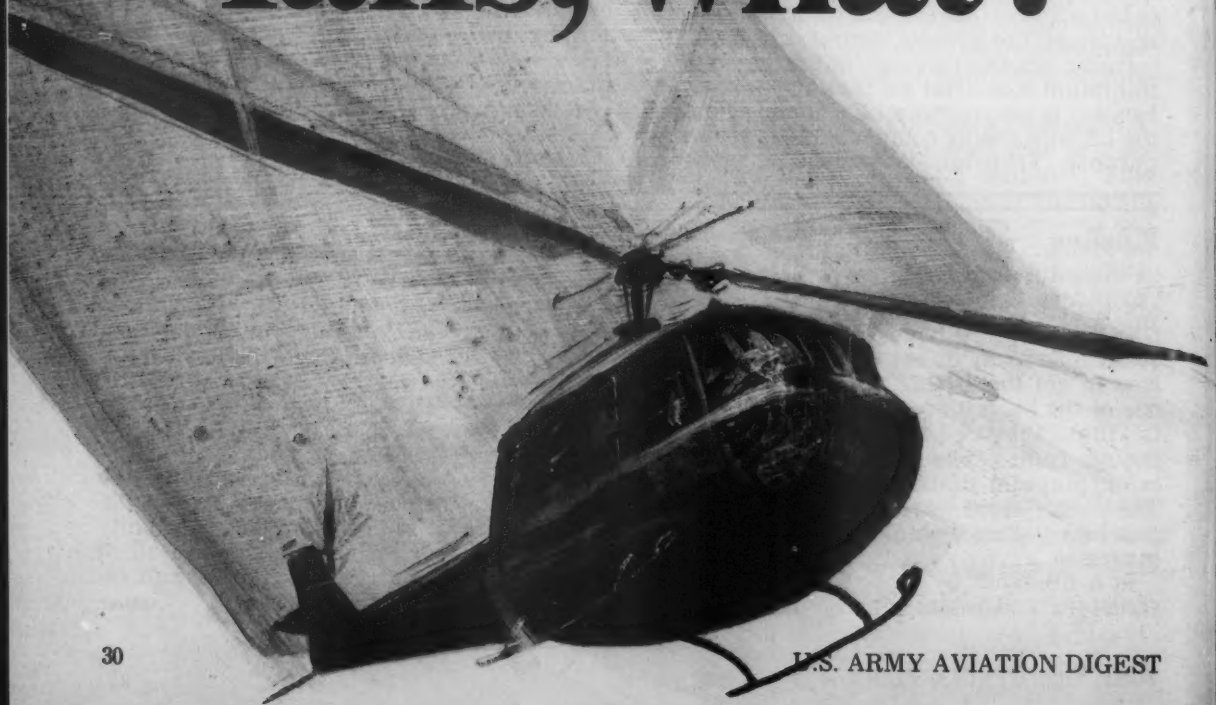
Also, to the captain who signed his survey sheet with, "Thanks for the opportunity to respond" – and to all of you who took the time to respond, thank *you!*

Patrick J. Hollifield
Directorate for Plans, Operations and Education
U. S. Army Agency for Aviation Safety

USAAAVS

The question of aircraft performance during unpowered autorotation is a matter of real concern to pilots. They want to know...

after the engine fails, what?



WHAT CAN a helicopter do with nine million foot-pounds of energy when the engine quits? Nine million foot-pounds is approximately the total energy possessed by a Huey helicopter at 1,000 feet agl. By taking a different look at helicopter flight, we will find some interesting answers. That is, we will look at the machine rather than the pilot. Manuals, schools, and boards tell the pilot how to fly the machine. However, Isaac Newton stated the physical laws for the machine, and the machine, unlike the man, cannot stretch or break these laws.

The question of aircraft performance during unpowered autorotation receives continual attention from both pilots and aircraft designers. Too many accident reports contain the phrase "while attempting to stretch the glide, the main rotor rpm bled off and the helicopter fell to the ground" or "while attempting to stretch the glide the airplane stalled and impacted in a nose-low attitude." This article looks at the energy requirements for flight after engine failure and at the source and limits of the energy supply. The question "can the glide be stretched, and if so, at what cost" is also considered. First, the power requirements are described, the energy level of the aircraft defined, and the energy-power relationship illustrated. This is then applied to unpowered flight in order to look at capabilities and limitations of this flight condition.

The terms work, energy, and power first require definition. These terms have definite meanings in engineering and physics and should not be used loosely in discussing helicopter flight. Work is the product of a force times a distance. Power is the rate at which work is done. As an example, drag is a force. Therefore, if a body (rotor blade or fuselage) is in motion and drag is present, work is being done and power is required. Finally, energy is a measure of a body's (a helicopter) capacity to do work. The two important types are chemical energy (fuel) and mechanical energy (potential and kinetic). Since work is done in changing energy, the rate at which energy is changed can be defined as power. Perhaps this is easier to understand if one thinks of an engine expending fuel (chemical energy) in order to produce power.

The power required for level flight conditions is given by the sum of the parasite power, induced power, and rotor blade profile power. The parasite and profile powers represent the energy required to propel the fuselage and nonlifting rotor through the air. The induced power represents the energy expended to maintain lift. The total power requirement for a utility helicopter is illustrated in figure 1.

For any airspeed-altitude flight condition, an energy level can be defined. The energy level of an aircraft at any given flight condition is the sum of the potential, kinetic, and rotor rotational energies. The energy level is a function of altitude, airspeed, rotor speed, gross weight, and rotor inertia. Technically the expression is described by:

$$\text{ENERGY} = (\text{Gross Weight}) * h + \tfrac{1}{2}\frac{GW}{g}V^2 + \tfrac{1}{2} I \Omega^2$$

In pilot's terminology the energy expressed is more simply:

ENERGY = Altitude (agl) + (Airspeed)^2 + (rpm)^2

What is the relationship between power and energy level during powered flight? The engine

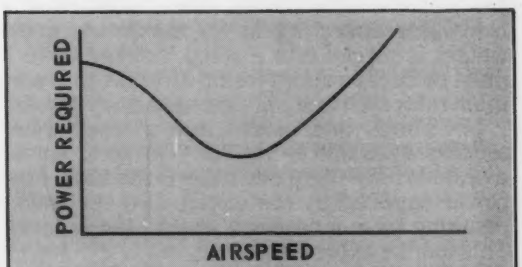


FIGURE 1.—Shaft horsepower required as a function of airspeed

AFTER THE ENGINE FAILS, WHAT?

provides power for flight. Therefore, the energy level can be increased only if the engine is capable of producing more power than is required during any flight condition. That is, if a helicopter can hover at 90 percent power, it can also accelerate into forward flight. Also, a helicopter possesses energy by virtue of its altitude and airspeed, and this energy is not unavailable. If the engine cannot supply the power necessary for a maneuver, additional power is gained from a reduction of the helicopter's total energy level. That is, if a helicopter operating at its maximum gross weight is placed into a steep, banked turn, it must be decelerating, losing altitude, or losing main rotor rpm to supply the necessary power.

Let's look one more time at the power sources available to a pilot. The total power available for a flight condition is the sum of the power supplied by the engine and the power resulting from a decrease of the energy level. This can be expressed by:

$P_{Available} = P_{Supplied\ by\ Engine} + P_{Supplied\ from\ decrease\ in\ energy\ level}$

We may now remove the engine, due to failure, from the picture. However, we cannot remove the power requirement for flight. A helicopter in steady-state, unpowered autorotation has almost the same power requirement as it does in level, powered flight at the same airspeed. The pilot can only reduce the power requirement so as to conserve a limited resource – energy. The total power for unpowered flight is supplied by decreasing the total energy level. This may be done by reducing main rotor rpm (a bad choice), reducing airspeed, or by descending. Since power is supplied only while the energy level is decreasing, descending and thus continually decreasing the potential energy of the aircraft is the best choice. Rate of descent can easily be expressed as a rate of decrease of potential energy; and, therefore, a source of power. The relation between the rate of descent and power supplied is illustrated in figure 2.

The power supplied by decreasing the rotor speed and airspeed is more difficult to illustrate. Also, it is limited to the time during which the decrease is taking place. There is limited benefit, however, in the fact that lower rotor speeds and lower airspeeds require less

power, but even this benefit lies in a very limited range. Remember the increasing power requirements on the back side of the power curve. The relation between airspeed and rate of descent is illustrated in figure 3. Note the rapid buildup in rate of descent at airspeeds lower than that for minimum rate of descent. The general shape of both figure 1 and figure 3 applies to all helicopters. The curve may shift up or down and the sides may not be as steep as illustrated, but the shape is the same.

At the moment the engine ceases to function, the energy level cannot be increased since only excess power can increase it. The power for flight is supplied by the continual drawdown of potential energy. Therefore, there must be, by physical law, a maximum distance the helicopter can fly. Slipping, changing direction, S-turning, or other control inputs only shorten this distance, since each of these actions requires additional power. The consequences of attempting to stretch the glide are well known to accident investigators. An accident usually results, with injury to crew or passengers.

The real world fact is that the capabilities of a helicopter are finite; that is, they have limits and these limits cannot be extended. It is true that some aviators can get more out of a ship. However, this is due to technique alone. They can fly with fewer control inputs or at a nearly zero sideslip angle. It is definitely not a case of getting the helicopter to perform in excess of its capability. That is impossible. Since the source of power to perform is limited, the performance is limited. At this point you may still be thinking that you can stretch your glide distance.

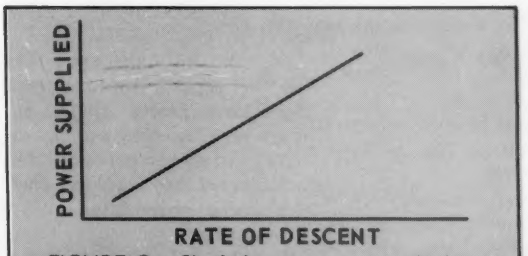


FIGURE 2.—Shaft horsepower supplied as a function of rate of descent

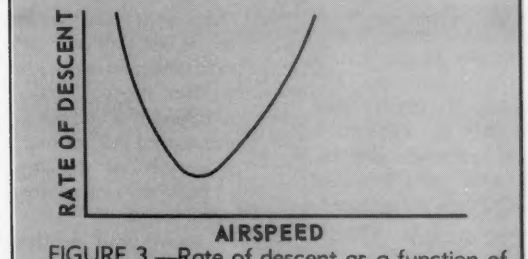


FIGURE 3.—Rate of descent as a function of airspeed

So far, only steady-state autorotation has been discussed, and this is only one of four phases of a successful autorotation. The factors from the entry into autorotation, the autorotation, and finally touchdown are many and their interrelationships are complicated. It can be assumed that tradeoffs have been made between the four phases to increase the chances of a favorable outcome. These tradeoffs show up in the emergency procedures of the operators manual and represent the optimal compromise. Time in the air (minimum rate of descent airspeed), or range (best range airspeed), is traded for something else. The trade is made for simpler procedures, larger margins of safety at critical points in the maneuver, etc. A good example may be that range has been traded for increased rotor speed at the deceleration and touchdown phases.

Simply stated, flight testing has verified the optimal compromise between helicopter capability and desired safety margin. This compromise appears as the emergency procedures for autorotational flight; and if the pilot is to benefit from this testing, he must accept and follow these procedures.

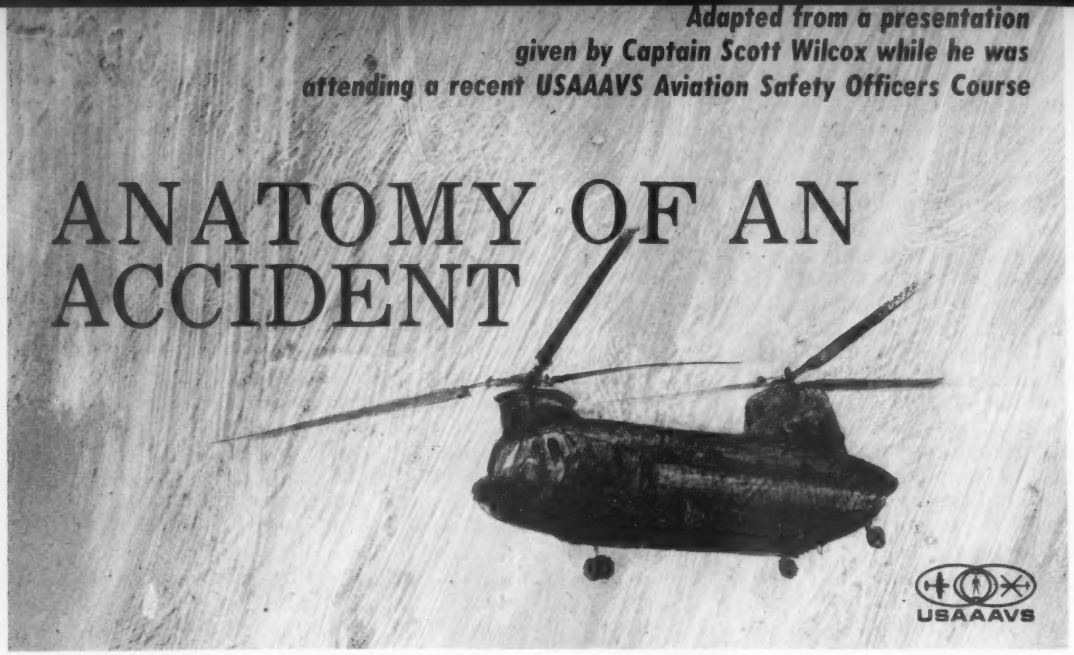
As a pilot there is nothing you can do to increase the capability of the unpowered helicopter, so why bend the procedures in an attempt to get just a little bit further. You can make your own tradeoffs, but consider what you are trading. You trade your margin of safety for a few more feet across the ground. Is this a fair trade?

To answer the initial question, nine million foot-pounds of energy can be used for two things. It can be a supply for the power required to perform a safe autorotation, or it can be expended in a futile attempt to move nine million pounds of earth one foot (i.e., a crash). The choice is yours.

By the way, fixed wing types, there is a moral here for you, too, if you substitute fixed wing aircraft for helicopters.

Adapted from a presentation given by Captain Scott Wilcox while he was attending a recent USAAAVS Aviation Safety Officers Course

ANATOMY OF AN ACCIDENT



FOLLOWING IS a fictitious account of an actual accident involving a CH-47 on a night troop rotation mission in marginal weather. The principal characters are:
CPT Persist - the platoon leader, an inexperienced aviator with less than 500 hours
CW3 Hightime - a pilot with lots of experience and common sense
1LT New - another inexperienced aviator with less than 300 hours and as green as his NOMEX
We open with CPT Persist and CW3 Hightime talking to the weather forecaster.

Forecaster: "The weather here is good enough for you to get out special VFR, but I won't guarantee it will stay that way or what it'll be like at your destination."

CPT Persist: "What do you mean?"

Forecaster: "You've got 3 miles visibility now, but we just received notification from the ground units in that area and they are reporting deteriorating ceilings with areas of ground fog building up. And with darkness coming on, the visibility isn't likely to get better."

CW3 Hightime: "Sounds like some nasty weather is trying to set in."

CPT Persist: "You know how those ground pounders are. They don't know fog from artillery smoke and couldn't see past the end of their weapons anyway. Let's go out there and show those duds how good aviators' eyes are."

CW3 Hightime: "Sir, from my experience the weather reports from the field have been pretty valid. You know how bad they want us to get in so they can get out of the woods and they wouldn't give that kind of observation unless it were true."

CPT Persist: "Well, it may be close, but let's go get a weather check anyway."

CW3 Hightime: "Well, sir, you heard the forecaster. It will probably get pretty bad in the field and it just might be IFR all the way back. I can't see taking the chance of going inadvertent IMC at night with a bunch of troops. Besides, I have my sick mother to think of."

CPT Persist: "I didn't know your mother was sick."

CW3 Hightime: "She will be when she hears I

cashed in my insurance policy for not using the good sense she gave me!"

CPT Persist: "I think you're just getting old and afraid to fly anymore!"

CW3 Hightime: "Go ahead. Say whatever you want. But I didn't get these senior wings from making dumb decisions and I won't take unnecessary chances with an aircraft for anyone."

CPT Persist: "OK, Mister, I'll get someone else to fly with me and report you to the old man when I get back."

CW3 Hightime: "That's your privilege, sir. But let me remind you that ground transportation was laid on in case of adverse weather and we couldn't make the mission."

CPT Persist: "I haven't forgotten. We can still make that mission. I'll get LT New to fly with me and show you what Army aviation is all about."

Would you fly under these conditions, with ground transportation available? Let's move on. CPT Persist has gotten LT New into operations to discuss the mission further.

CPT Persist: "I told you. Mr. Hightime just wasn't up to taking this mission. That's why I called you in."

LT New: "Well, I do need some time, but isn't the weather just a little tight?"

CPT Persist: "It'll be OK. We're not flying an airplane. All we need is room for the rotors under the clouds."

LT New: "Well, I don't know. The forecast is for marginal weather, and what does the unit SOP say about weather checks?"

CPT Persist: "The SOP doesn't cover weather checks so I'm in charge of this. Besides, you know the Air Force. They're used to forecasting for C-5As and anyway they're not pilots!"

LT New: "But, sir, going low level at night in bad weather doesn't sound too safe!"

CPT Persist: "Listen! Do you like being an aviator or not? You're getting paid to fly and I don't think you have enough experience to refuse a mission!"

LT New: "Well . . . OK, sir."

CPT Persist: "Atta boy!"

Talk about pressure! CPT Persist has pitted the mission against incentive pay to get LT New to fly the mission. They file their flight plan with ops and tell the crew chief to get the aircraft ready. After a hasty preflight and departure, LT New speaks.

LT New: "Boy! This is worse than I thought it would be. Don't you think the ceiling is getting lower?"

CPT Persist: "Yeah, but it's not that bad. We can still get under it and I'm sure it will get better when we get close to the LZ."

LT New: "That may be, but I think we had better turn back before we lose all contact. This mission isn't that important."

CPT Persist: "Listen! I said I'm going to complete this mission and I'm going to. We can always set down if it gets too bad."

LT New: "The ground fog is getting worse. I'm losing contact with the ground. You better get on the instruments."

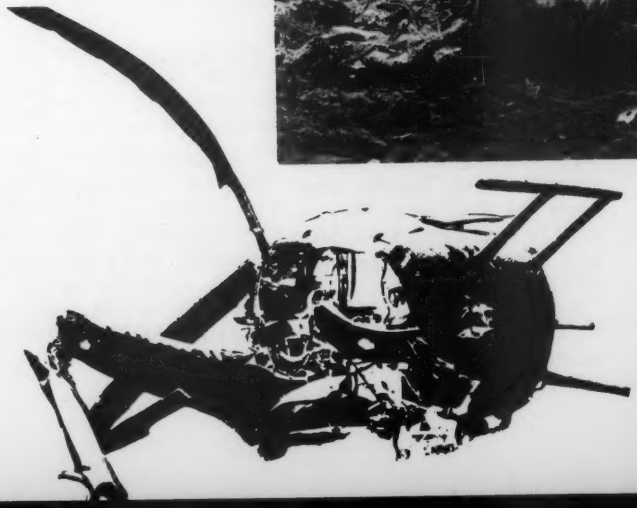
CPT Persist: "OK, I've got it. We can still stay VFR. I'll just turn a little south and try to find a hole. We just flew into a cloud . . . I can't see the ground . . . I'm getting dizzy and confused. You take it."

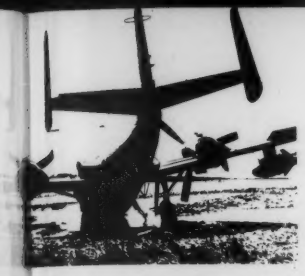
LT New: "I've got it! What's wrong with the instruments? Are we in a turn? I'm not sure . . ."

CPT Persist: (Shouting) "Rely on the gauges! Watch your attitude! Bring the nose up! Look out!!"

A smoking hole — a destroyed aircraft — lives wasted — all because an inexperienced crew was trying to stay VFR in IMC. This flight was unnecessary, didn't contribute to the unit's mission, and could have been avoided just by using common sense. Next time there is a question of marginal weather, think! What does the SOP say? What does common sense say?

ABOVE: Crew of this UH-1 flew into marginal weather conditions, tried to maintain visual contact, and crashed into a mountain. All seven people aboard were killed.





To progress means to move forward; and the quickest and best method can often be determined by examining past experience. Consequently, for rapid and positive improvement in aviation safety, we might pause briefly to ponder the question ...

where have we been?

USAAAVS

IN FY 1976, Army aircraft were involved in 94 flight accidents. These produced 55 fatalities, 93 nonfatal injuries, and 45 destroyed aircraft. The cost for damaged and destroyed equipment approached $19.5 million. In addition, 273 incidents during this period cost nearly $1.5 million. Based on DA Circular 385-48, the combined cost for fatal and nonfatal injuries exceeded $7.3 million, raising the total cost for all damage-producing mishaps to more than $28 million.

Of the 55 fatalities, 36 were aviators and 19 were nonaviators. Conversely, 37 aviators sustained nonfatal injuries as opposed to 56 nonaviators. All the fatalities occurred in 18 of the 94 occurrences.

Of the 94 aircraft destroyed or damaged, 82 were rotary wing and 12, fixed wing. Of all Army aircraft actively in service, only the CH-47 escaped involvement in accidents during FY 1976.

While the number of accidents decreased from 98 in FY 1975 to 94 in FY 1976, the number of fatalities more than doubled, and nonfatal injuries increased by approximately one-half. Similarly, costs for damaged and destroyed equipment rose by more than $2 million.

Although these statistics represent but a small fraction of those compiled to show our FY 1976 mishap experience, they do give us some idea of where we stand. Basically, we find ourselves on a plateau. While we had a slight decrease in the number of accidents in FY 1976 as compared with FY 1975, we have paid an inflated price in terms of lives and injuries as well as in dollars. Unless we want to repeat this performance in FY 1977, we must take corrective action now. But what kind of corrective action should we take? Raw statistics alone cannot supply the answer. We must first determine cause factors and then formulate a prescription that can effect a cure.

Analysis shows that in 72 of the 94 FY 76 accidents, errors on the part of the aircrew served as initial causes. Not only was pilot error an initial cause in nearly 77 percent of the FY 76 accidents, but it also appeared as a contributing factor 83 times.

WHERE HAVE WE BEEN?

It is not surprising, then, that 41 of the 55 fatalities, 62 of the 93 nonfatal injuries, and 35 of the 45 destroyed aircraft occurred in accidents in which crew error was the initial cause factor. Figure 1 shows the general types of crew errors and the number of times each occurred.

Of the remaining 22 initial cause factors, 18 were associated with materiel; one, with weather; one, with design; one, with maintenance; and one was not determined.

A closer look at some of the crew error accidents can more clearly point out specific problem areas.

In one instance, a UH-1 with six occupants was operating at a high hover over water when the aircraft began a clockwise rotation. The pilot was unable to regain control and the aircraft settled into the water approximately 125 feet from land. Although all six occupants escaped from the aircraft, three drowned while trying to reach shore.

The pilot's attempt to operate the aircraft outside the design envelope (over performance gross weight) was deemed the initial cause. The UH-1 was equipped with 300-gallon auxiliary fuel tanks containing approximately 1,950 pounds of fuel. Carrying this unnecessary fuel load for a short duration flight placed the loaded aircraft at or near maximum gross weight and was in violation of the unit SOP. In addition, the pilot was not current in the type aircraft he was flying, being more than 60 days overdue for his annual standardization ride. Nor was he experienced in operating the aircraft at or near its maximum gross weight.

Supervision was also a factor. The unit commander failed to monitor training and proficiency of the pilot, allowing him to fly without successfully completing the annual standardization ride.

At present, there is no requirement that mission validity and essentiality be determined and included in the accident report. However, for a mission to be considered valid, it must have been within the scope of the unit's capability, directed by proper authority, and the crew qualified, current and assigned in accordance with established procedures and regulations. To be considered essential, the mission must have contributed to the overall mission of the unit. Based on these definitions, the flight in question was neither essential nor valid.

Two aviators of limited recent flight experience were assigned to perform complex low-level night formation flight. Crew became disoriented and flew aircraft into trees.

In another instance, a pilot attempted a low-level, high-speed, left turn in an OH-6 that was near maximum gross weight. Part way through the turn, the aircraft encountered a downwind condition and settled, striking the ground with the main and tail rotor blades and the left skid. The aircraft then slid to a stop on its left side. The pilot and all three passengers were injured, and aircraft damage costs exceeded $50,000.

Again the initial cause was crew error. The pilot attempted aerobatic show maneuvers for which he was not qualified, and underestimated both ground clearance and aircraft operational capabilities. The unit SOP did not provide guidance for orientation flights such as this one and specific command relationships and guidance were not definitely established by the major command.

In a third accident, the IP aboard a UH-1 on a training flight attempted a VFR approach to base field when weather conditions warranted an instrument approach. He lost control and the aircraft crashed and burned approximately 4 miles from the airfield. All three occupants were killed and the aircraft was destroyed.

Although the initial error was made by the IP, supervision and weather played significant roles as contributing factors – first, by establishing a blanket requirement for aircraft to return to base fields in instances of bad weather to expedite the following day's training; and second , by allowing a 20-minute delay before recalling aircraft after the weather began deteriorating and conditions worsened.

As these accident briefs readily show, crew error was often reinforced by supervisory error. As a matter of fact, next to crew error, supervision was the most frequent contributing cause, appearing 50 times in the 94 accidents. It

IP attempted mission in an overgross UH-1 with a known "sick" engine. Five people were killed.

was present in 14 of the 18 fatal accidents, 10 of the 12 weather-related accidents, and in 29 of the 46 accidents in which aircraft were destroyed.

Materiel failure appeared as a contributing cause in 23 accidents, and was a factor in mishaps that produced 8 fatal and 29 nonfatal injuries. In decreasing order of frequency, failures included engines, tail rotor or related systems, fuel control units, a rotor mast, generators and alternators, nose gear steering and indicators, and main gear components. Significantly, in three of the four engine failures that occurred aboard rotary wing aircraft, prior indication of problems had been recorded.

NOE (nap-of-the-earth) and tactical support operational cause factors contributed to 18 accidents, and were present in mishaps in which 11 fatal and 26 nonfatal injuries occurred. Crew error served as an initial cause in 15 of these accidents; and materiel failure in the remaining three.

Training cause factors contributed to 17 accidents and were present in those that produced 10 fatal and 9 nonfatal injuries. In 11 of these accidents, unit training was deficient. In the remaining ones, either initial aviator training or maintenance training was listed as a contributing factor. Deficiencies in initial aviator training included insufficient amount of time devoted to instruction in weight and balance. IP training was deficient in that IPs are not identifying weak or marginally qualified pilots during evaluation flights.

Maintenance errors contributed to 15 accidents, and were involved in mishaps that produced 15 fatal and 28 nonfatal injuries. Deficiencies varied from reuse of self-locking nuts and improper torquing of hardware to contamination of transmission oil with water and debris, and failure to accomplish required maintenance and inspections by the book.

Fourteen accidents were the result of practice autorotations. Considering the variance of opinion in the past as to the value of this training, it is significant that a recent study shows approximately 82 percent of all actual emergencies which involved autorotation terminated successfully with no damage to equipment.

Crew error was the initial cause in each of the 14 practice autorotation accidents. In most instances, misjudgment in the application of cyclic, collective or yaw control during the touchdown phase was the principal cause.

Emergency autorotations contributed to 13 accidents. All were caused by materiel malfunctions. Seven of these accidents resulted in the total loss of the aircraft; five were major accidents; and one was classified as a minor accident. Collectively, they produced 3 fatal and 20 nonfatal injuries.

Engine malfunction caused eight of the emergency autorotations; tail rotor failures, four; and failure of a short shaft caused the remaining one. Three of the emergency autorotations occurred over water and two occurred at low level. One involved fire. Two of the emergency autorotations resulted from incorrect identification of the malfunction. One nonsurvivable accident was caused by the pilot's attempt to "stretch" the autorotative glide.

Weight and balance cause factors contributed to 9 accidents, 8 fatalities, and 14 injuries. In six instances, aircraft were over maximum gross weight; and in three, aircraft were out of CG. Crew error was the initial cause in each of these, and supervisory error was a

WHERE HAVE WE BEEN?

During hover firing, antitorque pedals stuck due to silent chain malfunction and aircraft landed hard. Maintenance inspection had not been performed by the book.

contributing factor in six.

Practice antitorque failures contributed to two accidents. In both accidents, crew error was identified as the initial cause.

Weather was a factor in 12 accidents. These produced 29 fatalities and 16 injuries.

General causes included pilots attempting to fly VFR during marginal weather, entering IMC and losing aircraft control as a result of vertigo or disorientation, and encountering severe turbulence.

Other cause factors in weather-related accidents were lack of responsible supervision, pressure to accomplish the mission, pilot overconfidence, and disregard or nonavailability of weather forecasts.

It is significant that 75 percent of the weather-associated accidents were nonsurvivable. This represents one-half of the 18 accidents in which fatalities occurred.

While this information has been greatly condensed, it does give a general view of the problem areas in our safety program along with some specific causes and results. But even this is not enough to produce a reduction in accidents and an overall improvement in aviation safety. Information from our accident experience must be carefully examined and corrective actions determined. This, of course, is an on-going process. Some recommendations formulated for evaluation are as follows:

- The discontinuance of practice antitorque malfunction maneuvers to the ground as a training requirement. (Demonstration of these maneuvers be given to students only during initial pilot training.)

No. Of Occurences	Type Error
29	Used flight controls improperly or failed to follow established procedures
10	IP failed to monitor SP
8	Exceeded aircraft limitations
7	Misjudged clearance or distance
5	Attempted visual flight in IMC
4	Became disoriented
4	Failed to monitor equipment performance
3	Selected course of action for which no established procedure exists
2	Involved transmission and receipt of communications
72	

Fig 1

- Closer supervision by entire local chain of command during operation in marginal, deteriorating, or impending severe weather.
- The reevaluation of inadvertent IMC procedures currently published in FM 1-1 which describe a 180-degree turn to return to VMC as the current course of action. (This procedure often causes disorientation or vertigo.) DA message 202037z Oct 76, subject, Inadvertent IMC Flight Procedures, directed that all MACOMs ensure that IMC plans be developed at each installation. Guidelines included DA-approved pilot actions to maintain aircraft control and IMC/IFR recovery procedures. These procedures will be published in Change 1 to AR 95-1.
- The reevaluation of crew placement in the cockpit. Often, the most experienced aviator in an aircraft involved in an IMC accident is seated in the left seat and does not have benefit of all instruments.
- The development of a "whiz wheel" or similar device to enable a pilot to quickly and easily compute weight and balance from his position in the cockpit.
- The expansion of weight and balance training with additional emphasis placed upon this subject during initial pilot training.
- The revision of performance charts for UH-1 aircraft, including the clarification of terms such as military power, normal power, and takeoff power. (Presently, these terms are poorly defined and inconsistently applied in reference to power charts.)
- The establishment of crew rest requirements to be incorporated Army-wide. (Fatigue continues to play a significant role in Army aviation accidents.) continued on page 47

what would you prescribe?

USAAAVS

Army regulations provide for temporary flying restriction of aircrewmembers due to "exogenous factors." Some of these factors may be overlooked at times since a flight surgeon may not be involved in the circumstances surrounding each. Check your knowledge by taking this brief exam.

I. Match the proper time in column I that an aircrewmember is "grounded" with each "exogenous factor" in column II.

COLUMN I		COLUMN II
a. 12 hours b. 24 hours c. 48 hours d. 72 hours e. 7 days f. 4 weeks	_____1.	While drinking and for_____after the last alcoholic beverage is consumed and until no residual effect remains.
	_____2.	While taking antihistamines for a cold or allergy and for_____after discontinued and until no residual effects remain.
	_____3.	While taking barbiturates for sedation and for_____after discontinued and until no residual effects remain.
	_____4.	While taking a tranquilizer or any other mood changing drug and for _____after it has been discontinued.
	_____5.	Following all immunizations except smallpox and for the duration of any systemic or severe local reaction.
	_____6.	After donating blood (200cc or more)
	_____7.	Following low altitude chamber flights. (Also, no heavy exercise during this period.)
	_____8.	After scuba diving (also may not participate in low altitude chamber flights during this period).

II. Answer true (T) or false (F).

_____1. Tobacco smoking has no significant physiologic effect that would degrade flying safety.

_____2. Strenuous sporting activities pose no problem in aircrew scheduling.

_____3. An aviator with 20/20 far vision and 20/25 near vision need not wear corrective glasses when performing flying duties.

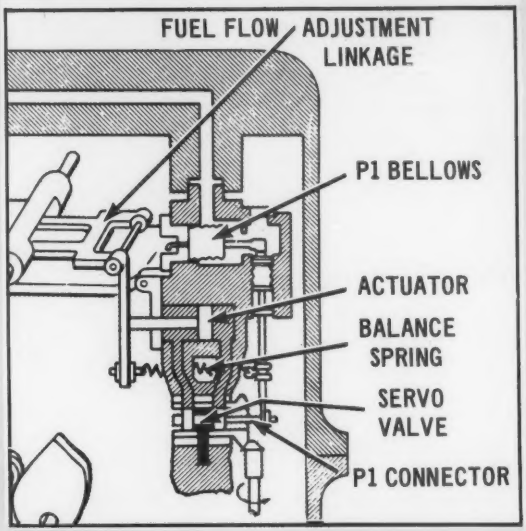
_____4. Aircrewmembers may wear contact lenses when off duty.

_____5. Aircrewmembers will inform their flight surgeon when they have participated in activities or received treatment following which flying restrictions may be appropriate.

III. The regulation which covers the above "exogenous factors" is _____. *Answers on page 47.*

Clarence J. Carter USAAAVS
Directorate for Aircraft Accident Analysis and Investigation
U. S. Army Agency for Aviation Safety

A LOOK AT P1 MULTIPLIER FAILURES



WE RECEIVE MANY questions about the T53-L-13B fuel control P1 multiplier connector, its function, history of failures, and status of the fuel control modification program. Perhaps this article will shed some light.

What is the P1 multiplier? The P1 system consists of a bellows, servo, actuator, and linkage. It automatically provides correct fuel flow for any pressure or altitude change the aircraft may be subjected to throughout the complete engine power range. The fuel flow is adjusted by the pressure change acting on the P1 bellows that causes it to expand or contract. This small movement is transmitted to the multiplier connector by the multiplier linkage. The multiplier connector (the part that fails) is actually the shaft of the servo valve. The servo valve position is balanced by a spring connected between the P1 fuel enrichment/derichment system and the P1 bellows to P1 connector linkage. When the P1 bellows expands or contracts due to a pressure change, it opens the servo valve by means of the P1 connector and allows servo fuel pressure to flow to the actuator, increasing or decreasing the fuel flow by extending or shortening the linkage to the main fuel flow valve. When the actuator piston is repositioned by servo pressure, the tension is changed on the balance spring, repositioning the servo valve and shutting off servo pressure to the actuator.

The only positive indication of a P1 connector failure is some kind of power interruption. In one instance, the only indication of failure was a 200 engine rpm fluctuation. On a subsequent test flight, a complete loss of power occurred. Sometimes failure may be accompanied by a loud bang or a compressor stall. In fact, there is no consistent pattern as to which way the fuel flow, and consequently, rpm, may go. In all recorded P1 failures, the engine rpm has decreased. However, there are no mechanical limits or stops to prevent the fuel flow from increasing after a failure.

All of the T53-L-13B-powered helicopters (AH-1G, TH-1G, UH-1H, UH-1M) are equipped with a rotorspeed warning system to indicate overspeed or underspeed. If a P1 connector failure occurs in flight, the warning this system gives will be the first indication the pilot will have unless he is looking directly at the engine instruments at the moment the failure occurs. Rotor speed should be the pilot's first consideration. Only after rotor rpm is stabilized should another action be considered. If N1 (compressor speed) and egt (exhaust gas temperature) are within safe limits (N1 40 to 101.5, egt 450-690) after rotor rpm has been stabilized, the emergency governor, or manual mode, should be considered. The decision to switch to the manual mode should be accomplished before N1 has decreased below 40 percent. Otherwise, precise and careful throttle application will be necessary to bring the N1 up to operating speed without causing overtemp and engine burnout. The applicable dash 10 procedure should be strictly adhered to and the egt monitored very closely during

manual power changes. Once the aircraft is stabilized with the fuel control in the manual mode, flight can usually be continued to the original intended point of landing. After the desired cruise power settings are obtained in the manual mode, throttle and collective friction can be adjusted to maintain desired setting and the aircraft controlled by the application of cyclic.

According to records at USAAAVS, 13 P1 multiplier connector failures have caused mishaps since March 1971. The last seven of these occurred since February 1975 and resulted in a dollar loss of approximately $433,000. In 10 of the 13 failures, engines did not stop operating. Consequently, had the pilots involved been aware of the P1 connector failure mode and taken proper action, they might possibly have prevented these mishaps. Briefs of recorded failures are listed as follows:

1. AH-1G - Engine lost power and skids collapsed on touchdown.

2. AH-1G - Partial power was lost and autorotation made to a safe landing.

3. UH-1M - Pilot entered practice autorotation. Upon application of power, N1 decreased to 25 percent and egt increased to 700 degrees. Aircraft landed hard.

4. UH-1H - Engine stopped in climb and synchronized elevator struck wire on landing.

5. UH-1H - Engine lost power and aircraft was landed with low rpm.

6. UH-1H - Aircraft yawed left and rpm audio came on. On landing, aircraft impacted tail low, severing main rotor and tail boom.

7. UH-1H - N2 decreased and running landing was made to plowed farm field. Main rotor blade struck tail rotor drive shaft.

8. UH-1H - Engine lost power and aircraft was landed on two-lane highway, causing main rotor blades to strike telephone poles.

9. UH-1H - Engine stopped at approximately 1,500 feet agl. Loud bang was heard and aircraft yawed hard to the right. Aircraft was autorotated into wooded area.

10. UH-1H - While in cruise flight at 500 feet and 100 knots, engine stopped with no warning. Aircraft yawed slightly nose left and autorotation was made into canal.

11. UH-1H - During cruise flight at low level, engine failed at approximately 100 feet agl. Pilot completed autorotation to a downhill slope. Main rotor blades severed tail boom on touchdown.

12. UH-1H - While in cruise flight at 4,000 feet msl and 100 knots IAS, aircraft yawed 10°-15° left, low rpm audio sounded, and rpm warning light came on. N2 decayed to 3000 rpm, N1 fluctuated between 35 and 40 percent, torque pressure dropped to zero, engine oil pressure decreased to 1-10 psi and engine oil pressure caution light came on. Pilot autorotated aircraft to plowed field with partial power.

13. AH-1G - Engine failed during cruise flight at 1,000 feet. Pilot entered autorotation and made descending left turn to dirt road. Aircraft landed hard, sustaining major damage.

In August 1975, 263 modified fuel control units were available. Since then, Corpus Christi Army Depot (CCAD) has modified approximately half of all the fuel controls in the supply system. A check with selected units shows approximately 45 percent of the T53-L-13B-powered helicopters are presently equipped with the modified fuel control. CCAD plans to modify 200 controls per month until all units have been modified. At this rate, AVSCOM can initiate a program to purge the unmodified fuel controls from the system by July 1977.

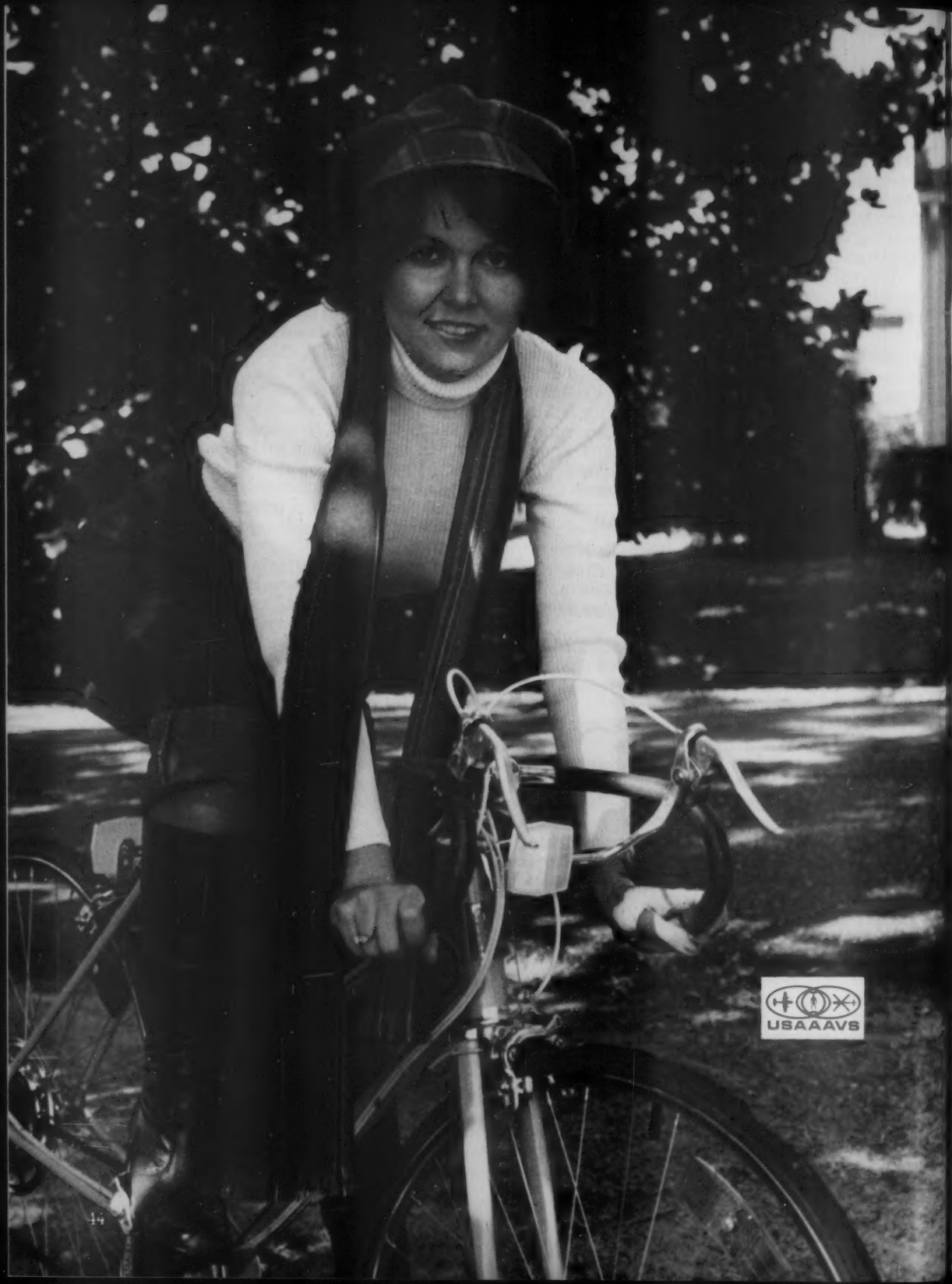
Based on the present rate of failure, we can expect at least five more in-flight failures to occur before the modification program is completed. If the pilot who experiences such a failure has enough altitude and is proficient in his emergency procedures for low-side governor failure, chances are he can make a safe landing at a suitable area or airfield. Following are some actions units can take until all fuel controls are modified:

- Conduct an intensive awareness program on P1 multiplier failures and associated emergency procedures.

- Determine the part number of the fuel control your T53-L-13B-powered helicopters are equipped with. This information is found on the fuel control data plate. Fuel controls bearing part number 84200A7 are the only ones that have been modified. (If the part number ends in any number other than 7, the control has not been modified.) Placard the aircraft so the type of fuel control will be readily apparent to the pilot.

- Ensure pilots are aware of correct emergency procedures and that they know the fuel control status prior to flight.

- Whenever feasible, schedule only those aircraft with modified fuel controls for NOE, flight in IMC, and missions that are not conducive to flight in the emergency governor mode.


USAAAVS

PEARL'S

Personal Equipment & Rescue/Survival Lowdown

If you have a question about personal equipment or rescue/survival gear, write Pearl, USAAAVS, Ft. Rucker, AL 36362

UH-1 Jump Seat Lapbelt

Many of you have asked for additional clarification on the attachment of the UH-1 jump seat lapbelt (Pearl, AVIATION DIGEST, January 1977). The passenger lapbelt, NSN 1680-00-447-9504, is normally used for the jump seat and is attached to the rings on the seat frame. However, personnel small in stature cannot tighten this belt to the desired level for proper restraint because of the lapbelt's excessive length. Therefore, the pilot/copilot lapbelt, NSN 1680-00-976-1831, may be used and attached to the floor tiedown rings as shown in figure 1 of the above mentioned article. This belt can be adjusted to the desired level for proper restraint.

A recent UH-1 accident caused failure of the cargo tiedown fittings to which passenger lapbelts had been attached. To investigate these failures, the U.S. Army Aeromedical Research Laboratory (USAARL) and USAAAVS conducted pull tests on UH-1 cargo tiedown fittings. These fittings failed at lower levels than the jump seat anchor rings reported by USAARL in 1971.

The part of the cargo tiedown assembly that failed was the straightheaded pin, NSN 5315-00-812-3750, P/N MS20392-1C17, identified in TM-55 1520-210-34P, page 438, figure 73, item 23. This pin bends under a load and causes the clevis portion of the door assembly ring, NSN 1680-00-802-3204, P/N FDA1886, to spread. In this configuration, the pin fails at either the head or keyed end and separates from the pin in the floor, NSN 1680-00-991-8570. Due to the low strength of the straight headed pin, USAARL, USAAAVS, and USAAVSCOM recommend the lapbelt be attached to the jump seat lapbelt anchor rings. Additional testing will be done with pins heat-treated to determine their strength and subsequent use.

Proper Wear of Survival Vest/ Waterwings

The article entitled "Ditching the Huey" in the October 1976 ARMY AVIATION DIGEST has caused some controversy in our unit. The article referred to wearing the SRU-21/P survival vest over the underarm waterwings. As we do not have access to TM 55-8465-215-10, I am requesting information concerning the proper wearing of the survival vest in combination with the waterwings. We discovered that when the waterwings are worn underneath the survival vest, the waterwing pouches must protrude through the armpit holes of the survival vest. And the waterwing harness must be adjusted so the waterwings are firmly fitted underneath the pilot's arms.

I need to know the correct method of wearing the waterwings in conjunction with the survival vest.

The underarm life preserver, LPU-2/P or LPU-10/P, should be worn under the SRU-21/P survival vest. There are several reasons for this procedure: (a) comfort; (b) interference of the life preserver chest straps with survival vest pockets (depending on body size); and (c) to preclude loss of the life preserver in rough water or in case of injury or unconsciousness. The U. S. Air Force also wears the life preserver under the survival vest for these reasons.

SRU-21/P Survival Vest

Would you send me a complete list and NSNs of the components in the survival vest and an inspection sheet.

The NSN for the SRU-21/P survival vest with components is 8465-00-177-4819. The survival vest may be ordered without the components by NSN 8465-00-177-4818. A listing of all vest components appears in the November 1974 ARMY AVIATION DIGEST. Inspection of the vest and its components may be found in TM 55-1680-317-23&P, Organizational and DS Maintenance Manual Including Repair Parts and Special Tools List for Army Aircraft Survival Kits, paragraph 2-18, page 2-84.

Life Support Equipment Needed on all Flights

Analysis of last year's accidents shows that life support equipment is not being made available or else not carried

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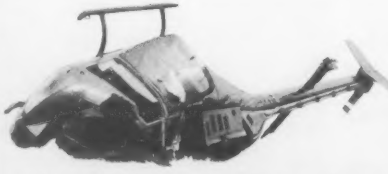
Personal Equipment & Rescue/Survival Lowdown

aboard the aircraft. In one accident the pilot survived the crash but died before the wreckage was found. The crash occurred within 2 miles of the runway. No radio or signal devices were aboard the aircraft. In another case, a student pilot was pinned in the wreckage for more than 1 hour with fuel dripping on his face. The IP had to walk out for help because a survival radio was not on board.

Our mishap files contain many cases proving the need for survival gear, especially signaling equipment, aboard the aircraft on all flights. Yet, our field visits show that many times the equipment is available but not issued or issued but not used. Pilots must have survival gear and they must use it. Crashes need not occur in remote areas to create a need for life support equipment. SOPs should specify that essential gear will be carried on all flights.



OH-58 CONTROL REMOVAL

Three OH-58 accidents have been caused by nonrated personnel inadvertently moving the aircraft controls during flight. Fortunately, these three aircraft were only slightly damaged. The same cause factor was suspected in two other OH-58 accidents involving four fatalities. There is no way of knowing how many aviators have been just seconds away from the same type of accident but were able to regain control.

TM 55-1520-228-10, page 2-20, paragraph 2-29, contains a caution note which answers the problem.

"CAUTION--When carrying nonrated passengers unfamiliar with the operation of the helicopter, the pilot should evaluate the mission as to the advantages and disadvantages of stowing the copilot's controls or accepting the responsiblity of the potential hazard when leaving the controls in place."

The copilot's controls can be easily removed. It takes only 5 minutes to do it. USAAAVS recommends removal of the controls when a nonrated person will be in the copilot's seat. This is just one more bit of insurance against an accident and the premium is only 5 minutes of the pilot's time.

WHERE HAVE WE BEEN? continued from page 40

While recommendations such as these are being proposed for evaluation, problems involving materiel and design have been assigned to appropriate agencies, including respective manufacturers, for correction. And while it will take time, money, and effort to obtain solutions to these and other problems, we can expect positive results.

But no matter how successful we may be, if we fail to successfully deal with those problems that involve human factors, namely the pilot, we can never hope to obtain more than minimal improvement in safety. And the reason is obvious.

If, in FY 1977, we should be able to eliminate accidents from every initial cause factor other than that associated with the pilot, we can expect to reduce our total number of accidents by only 24 percent over FY 76. Despite this decrease, the number of fatalities and injuries will rise as will the dollar cost. Obviously, the area in which improvement can produce the greatest benefits is the one associated with pilot errors. It is also the most difficult to cope with.

While no panacea exists for the safety ills associated with pilot factors, there are things we can do to deal with the problem. First we must admit we are part of the problem.

How many mishaps, for example, are you familiar with in which failure to perform a thorough preflight was the initial cause factor? Has your attitude been one of "that won't happen to me"? Hopefully, it won't, but it is happening to somebody, for we are still having mishaps from this cause – and they are occurring to both the inexperienced pilot and the veteran.

The next step is to look to those who have the greatest influence over the pilot – the supervisors at every level. It was supervision that assigned the newest and least experienced pilot in one unit to test fly an OV-1 on a day that weather conditions were almost marginal. When mechanical problems developed, the pilot, hampered by weather, could not cope with them and the aircraft crashed. In another instance, supervision properly assigned the most experienced aviator in the unit to transport a VIP passenger. The problem was this pilot had just completed another mission and had barely gotten to bed when the phone awakened him. He delivered his passenger to his destination, but on the return flight, weather conditions forced him to go on instruments. In his near-exhausted condition, he was not able to handle the situation and crashed.

But knowing the ability and condition of each pilot before assigning him a mission is only one function of supervision. For example, take a look at your unit SOP. Are the established policies sound ones based on needs to ensure safety or do they just meet the requirement for an established SOP? What is even more important, are these procedures enforced? Does your safety officer have the freedom and support necessary to accomplish his job effectively?

A most important question is how are we using the safety tools available to us? Are we using them to produce results or simply for appearance's sake? Are we really concerned with safety or are we more interested with aircraft availability, hours flown, and missions completed?

Dealing with human factors is a highly complex matter, and the token examples presented barely scratch the surface. Further, no one – no matter how knowledgeable and experienced – can, from a distance, formulate safety policies that will encompass all vital areas of flight operations and assure safety. One unit may be operating in a geographic area where snow, ice, and wind present special problems. Another may be faced with an entirely different set of hazards. Type of aircraft, terrain features, the presence of natural and manmade obstructions, as well as the nature of the missions being flown, all play major roles in the establishment of local policies and the enactment of controls to ensure safety. The bulk of this responsibility rests with supervision, particularly that within a unit.

We know where we stand, we have the means with which to travel, and we have a current road map. So, for FY 1977, the question that remains to be answered is no longer where have we been, but where are we going?

ANSWERS TO "WHAT WOULD YOU PRESCRIBE?"

I. 1. a
2. b
3. b
4. f
5. a
6. d
7. a
8. b

II. 1. F
2. F
3. F
4. F
5. T

III. AR 40-8

ATC action line

UNITED STATES ARMY AIR TRAFFIC CONTROL ACTIVITY

WHAT DO PILOTS mean when they tell a controller they have "got the beacon"? Are they on an approach crossing a marker beacon? Do they see the airport rotating beacon or is the transponder showing a radar beacon? Perhaps they mean the automatic direction finder receiver is homing on a radio beacon or are they in the twilight zone and navigating on an airway beacon?

The spoken word is the poorest form of communication. There is reason to believe the ambiguity of certain words has played an important part in more than one fatal accident. The National Transportation Safety Board recommends that such a term as "beacon" be used with a qualifying word whenever used in air traffic control messages.

Last March two airmen in a Cessna 172 became lost over West Virginia and finally asked for aid from the Washington Air Traffic Control Center at Gettsyburg, PA. The Center attempted unsuccessfully to get them down at Cumberland, MD; however, they flew on toward Garrett County Airfield where they ran out of fuel 2.5 miles from the airfield, touched down in an open field and fatally crashed into a line of trees. During the attempt to get down at Cumberland (a nontower airport with nondirectional beacon approach), the center controller advised the pilot the airport was at 12 o'clock and 2 miles. The pilot responded, "We have the beacon." The controller then said, "If you have the field in sight you are cleared to land." Actually, the pilot was referring to the radio beacon and never had the airfield in sight. The added time expended as a result of this misunderstanding may have been just enough for the plane to have had a successful landing at the final airport rather than a fatal landing in the trees short of the runway. Further, a pilot should not rely solely on the operation of an airport rotating beacon to indicate instrument flight rules or visual flight rules weather conditions. There is no Federal Aviation Administration regulatory requirement for daylight (beacon) operation.

Readers are encouraged to send questions to:
Director USAATCA
Aeronautical Services Office
Cameron Station, Alexandria,
VA 22314

Instrument "IQ"

Continued from page 17

completion of flight to destination airports in the event of communications failure. Therefore, use of STARs is restricted to DOD aircraft equipped with two functioning transceivers compatible with air traffic control."

16. False. DOD FLIP, General Planning, chapter 5. "The purpose of this service is to proceed to the extent possible separation between all *participating* VFR aircraft and all IFR aircraft.... These programs are not to be interpreted as releasing pilots of their responsibilities to see and avoid other traffic operating in the basic VFR...."

17. DOD FLIP, General Planning, chapter 8. Lawson Army Airfield, special report made at 0825Z. Partial obscuration, measured 300 broken, estimated 1,000 overcast, visibility 1 mile with heavy rain showers. Sea level pressure 1023.7mb., temperature 75 degrees F, dew point 68 degrees F, wind from 330 degrees variable to 030 degrees at 12 knots, gusting to 21 knots. Altimeter setting 30.23. Runway 32 visibility range is 4,000 feet.

18. False. FAA Manual 7110.65, para 321(a) (Terminal Air Traffic Control). For departing or enroute aircraft, a clearance beyond the clearance limit will be issued at least 5 minutes before the aircraft reaches the clearance limit.

19. b. AIM, November 1976, page 1-74, para 3. In order to ensure that you do not fly outside your protected circling airspace (1.3 miles for category A aircraft) you should make an initial climbing turn toward the landing runway.

20. True. FAA Handbook 8260.3A (TERPS), para 1100a and 1103. Remember, at termination of a copter instrument procedure, you are expected to land on one particular spot or pad as depicted on the approach chart.

(Photo by Debbie Caskey)

1st Brigade Is Back

THE RED, BLUE and gold colors of the 1st Aviation Brigade are flying again. In a colorful ceremony at the U.S. Army Aviation Center, Ft. Rucker, AL, they replaced those of the Army Aviation Center Troop Brigade that have been retired.

Along with the change of colors there was a change of command. Colonel George Powers replaced Colonel Anthony J. Adessa, who leaves Ft. Rucker for an assignment in the Directorate of Combat Developments, U. S. Army Air Defense School, Ft. Bliss, TX. Colonel Powers' most recent assignment was Director of Resource Management at Ft. Rucker.

The origins of the 1st Brigade date back to December 1961 when the 8th and 57th Transportation Companies arrived in Vietnam with their CH-21 Shawnee helicopters. The Transportation Companies later were redesignated as the 117th and 120th Assault Helicopter Companies and were incorporated into the brigade at its formation. They were the oldest active "Golden Hawk" units.

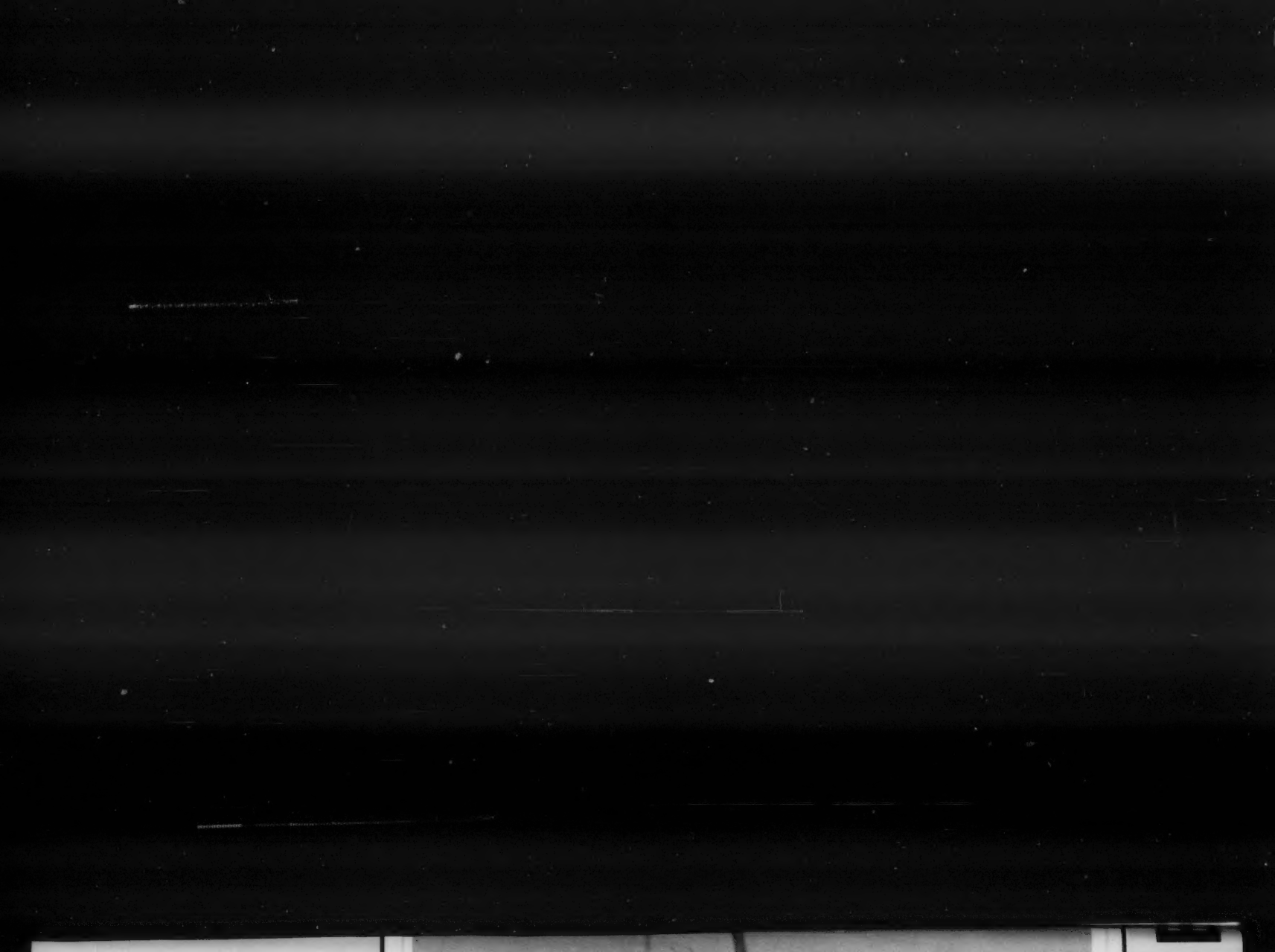
The 1st Aviation Brigade was organized in Vietnam in March 1966 to provide troop transportation, aerial weapons support, tactical fixed wing transportation, surveillance, reconnaissance and administrative support for combat units in Vietnam. In April 1973 the brigade was reduced to zero strength and the colors and memorabilia of the unit were accepted at Ft. Rucker (see "'Hawk' Colors Flying At Fort Rucker," *U. S. ARMY AVIATION DIGEST*, May 1973).

The "Golden Hawks," as the brigade came to be known, grew to a force of 23,000 men flying and maintaining 2,000 aircraft in Vietnam. The brigade's aircraft, both fixed and rotary wing, were in the air 24 hours a day to provide tactical support for all free world forces there – "from the Delta to the DMZ." The brigade is credited with carrying more than 37 million men into battle, evacuating thousands and 92,000 enemy killed.

The 1st Aviation Brigade consists of four battalions: the 1st, 4th, 6th and 46th Engineer (combat/heavy battalions). Troops representing all four battalions passed in review during the ceremony. Music was provided by the 98th Army Band.

Those authorized to wear the patch include personnel at Brigade Headquarters, commanders and staff of 1st, 4th and 6th Battalions, and of 11th, 12th, 13th, 14th, 15th, 41st, 42d, 43rd, 61st, 62d, 63rd and 64th Companies. This involves approximately 190 people.

All other personnel assigned to the Aviation Center, including both permanent party and students, will continue to wear the Aviation Center patch.

The central figures in the change of command review troops representing the newly redesignated 1st Aviation Brigade. Standing from left are Colonel Anthony J. Adessa; Colonel George Leaf, commander of troops for the ceremony; and Major General James C. Smith, post commanding general

Cover photos are of the Soviet Mi-24 helicopter code named "Hind." Read "Behind The Hind," page 4, and "Soviet Airmobile Tactics" which begins on page 1